

Main



SELECTED

 **WATER**

**RESOURCES**

**ABSTRACTS**



**VOLUME 12, NUMBER 8**  
**APRIL 15, 1979**



W79-03501-W79-04000  
CODEN: SWRABW

TC1  
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No. 8

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# SELECTED WATER RESOURCES ABSTRACTS

**S**elect Water Resources Abstracts, a semi-monthly journal, includes abstracts of current monographs, journal articles, reports, and other documents covering the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the hydrogeology, hydrology, hydrochemistry, hydrogeophysics, hydroinformatics, conservation, and management of water resources. Each abstract includes a brief description to identify the document and its source. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the hydrogeology, hydrology, hydrochemistry, hydrogeophysics, hydroinformatics, conservation, and management of water resources. Each abstract includes a brief description to identify the document and its source.

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To provide WRSIC with rapid, selected information on active water resources research programs are supported as "centers of competence" responsible for collecting, summarizing, and integrating information on specific topics.



**VOLUME 12, NUMBER 8  
APRIL 15, 1979**

W79-03501--W79-04000

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department.

Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

# SELECTED WATER RESOURCES ABSTRACTS

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**A**s the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.



APRIL 15, 1983

0200-1200-0000

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## FOREWORD

**S**elect Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus**. Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

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**Selected Water Resources Abstracts** is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by co-ordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstract-

ing, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center  
Office of Water Research and Technology  
U.S. Department of the Interior  
Washington, DC 20240

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## SUBJECT FIELDS AND GROUPS

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### 02 WATER CYCLE

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Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

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## ABSTRACT SOURCES

# SELECTED WATER RESOURCES ABSTRACTS

## 1. NATURE OF WATER

### 1A. Properties

#### ALIPHATIC ACID ANIONS IN OIL-FIELD WATERS—IMPLICATIONS FOR ORIGIN OF NATURAL GAS

Geological Survey, Menlo Park, CA. Water Resources Div.

W. W. Carothers, and Y. K. Kharaka.

The American Association of Petroleum Geologists Bulletin, Vol. 62, No 12, p 2441-2453, December 1978. 5 fig, 1 tab, 37 ref.

Descriptors: \*Organic acids, \*Subsurface waters, \*Oil fields, \*Natural gas, \*Chemical reactions, Geology, Temperature, Depth, Chemical analysis, Alkalinity, Ions, Texas, California, \*Origin of natural gas, \*Formation waters, \*Acetate, \*Decarboxylation, Proximity indicator, San Joaquin Valley, Brazoria County, Galveston County.

Concentrations of short-chain aliphatic acid anions (acetate, propionate, butyrate, and valerate) in 95 formation-water samples from 15 oil and gas fields in San Joaquin Valley, California, and Houston-Galveston and Corpus Christi areas, Texas, show three temperature regimes. The reservoir rocks consist of marine sandstones ranging in age from Eocene through Miocene. The aliphatic acid anions of formation waters in zone 1 (subsurface temperatures lower than 80°C) are characterized by concentrations less than 60 micrograms per liter and consist predominantly of propionate. The concentrations of aliphatic acid anions in zone 2 (temperatures 80 to 200°C) are much higher (up to 4,865 micrograms per liter) than in zone 1 and decrease with increasing subsurface temperatures and age of their reservoir rocks. Acetate forms more than 90 percent of the total anions. No aliphatic acid anions are believed present in zone 3 where the temperatures are higher than 200°C. Microbiological degradation of acetate and dilution by mixing with meteoric water most likely explain the composition and concentration of aliphatic acid anions in zone 1. The trends in zone 2 and the absence of acid anions in zone 3 are explained by thermal decarboxylation of these acid anions. Aliphatic acid anions generally contribute more than 50 percent and up to 100 percent of the measured alkalinity in the samples of zone 2. Their contributions to the alkalinity in zones 1 and 3 are small. The aliphatic acid anions mainly result from the thermocatalytic degradation of kerogen. (Woodard-USGS)

W79-03558

#### FRESH GROUNDWATER BENEATH CONTINENTAL SHELF: FINDINGS OF ATLANTIC CONTINENTAL-MARGIN DRILLING PROGRAM

Geological Survey, Woods Hole, MA. Water Resources Div.

F. A. Kohout, M. H. Bothner, and F. T. Manheim. American Association of Petroleum Geologists Bulletin, Vol. 61, No. 5, p. 804, May 1977.

Descriptors: \*Freshwater, \*Groundwater, \*Continental shelf, \*Atlantic Ocean, \*Northeast U.S., \*Southeast U.S., Drilling, Test wells, Sampling, Water analysis, Water quality, Salinity, Connate water, Marine geology, \*Offshore drilling.

The drilling of 22 test holes on the Atlantic Outer Continental Shelf has for the first time provided a semiquantitative picture of fresh groundwater in offshore areas. Salinity of subseafloor sediments was determined from 175 samples of interstitial water squeezed from sediment cores with a hydraulic press. Data from 5 of the test holes on a transect across the shelf from the New Jersey coast permitted construction of a cross section through the lens of relatively fresh water and the transition zone to seawater. The cross section indicates that low-salinity water (less than 2 parts per thousand) extends more than 16 km offshore and that salinities below 6 parts per thousand extend more than 100 km from shore. (Woodard-USGS)

W79-03562

#### ORIGIN OF FRESH GROUND WATER BENEATH THE U.S. ATLANTIC CONTINENTAL SHELF

Geological Survey, Woods Hole, MA. Water Resources Div.

F. A. Kohout, F. T. Manheim, M. H. Bothner, and D. F. Delaney. Ground Water, Vol 16, No 5, p 360, September-October 1978.

Descriptors: \*Freshwater, \*Groundwater, \*Continental shelf, \*Atlantic Ocean, \*Northeast U.S., \*Southeast U.S., Drilling, Test wells, Water analysis, Reviews, Aquifers, Groundwater movement, Connate water, Salinity, Marine geology, \*Offshore drilling.

An understanding of the distribution of fresh ground water and the nature of the transition zone to sea water in aquifers underlying the Continental Shelf is beginning to emerge from pre-water studies. On Long Island and extending south to Florida, recharge is known to pass from surficial deposits into underlying aquifers. Although continuous flow systems from mainland to offshore aquifers may exist, calculations by H. R. Henry (1962) suggest that even in the relatively permeable limestones of the Floridan aquifer, adjustment of the salt front to a condition of hydrodynamic equilibrium with the present level of the sea would require in excess of 30,000 years. (Woodard-USGS)

W79-03589

#### FRESH GROUND WATER FOUND DEEP BENEATH NANTUCKET ISLAND, MASSACHUSETTS

Geological Survey, Woods Hole, MA. Water Resources Div.; and Geological Survey, Boston, MA. Water Resources Div.

F. A. Kohout, E. H. Walker, M. H. Bothner, and J. C. Hathaway. Journal of Research of the US Geological Survey, Vol 4, No 5, p 511-515, September-October 1976. 2 fig, 21 ref.

Descriptors: \*Freshwater, \*Groundwater, \*Continental shelf, \*Massachusetts, \*Islands, Test wells, Deep wells, Aquifers, Connate water, Sampling, Groundwater movement, Water analysis, Water quality, Salinity, Marine geology, Evaluation, \*Nantucket Island, Glacial outwash.

In a deep water-resources and stratigraphic test well near the center of Nantucket Island, about 30 miles off the New England coast, freshwater has been found at greater depths than predicted by the Ghyben-Herzberg principle. An uppermost lens of freshwater, which occupies relatively permeable glacial-outwash sand gravel to a depth of 520 feet, is believed to be in hydrodynamic equilibrium with the present level of the sea and the height of the water table. However, two zones of freshwater at 730 to 820 ft and 900 to 930 ft are anomalously deep. Although several explanations are possible, the most likely is that the entire surface of the Continental Shelf was exposed to recharge by precipitation during long periods of low sea level in Pleistocene time. After the last retreat of glacial ice, seawater rapidly drowned the shelf around Nantucket Island. Since then, about 8,000 years ago, the deep freshwater zones which underlie dense clay layers have not had time to adjust to a new equilibrium. Under similar circumstances, freshwater may remain trapped under extensive areas of the Continental Shelf wherever clay confining beds have not permitted saltwater to intrude rapidly to new hydrodynamic equilibria positions. (Woodard-USGS)

W79-03690

## 2. WATER CYCLE

### 2B. Precipitation

#### CLIMATE, CLIMATIC CHANGE, AND WATER SUPPLY

National Research Council, Washington, DC. Studies in Geophysics. National Academy of Sciences, Washington, D.C., 1977. 132 p, 58 fig, 31

tab, 320 ref. Panel on Water and Climate, National Research Council.

Descriptors: \*Water supply, \*Climate, \*Climatic change, \*Socio-economic aspects, \*Water resources, \*Design, Methodology, Estimating, Forecasting, Water demand, Water shortage, Planning, Effects, Colorado River basin, Southwest U.S., Northeast U.S., Optimization, Mathematical models, Systems analysis, Transfer-function analysis, Bibliographies.

This volume contains essays presented at an American Geophysical Union meeting in Washington, D.C., in April 1976. Evaluated are the interactions between hydrology, water supply, climate, and climatic change. Areas where deficiencies in knowledge and data make rational water resource decision making more difficult than it need be are highlighted. Represented are authors from diverse disciplines, and the subject matter covers a wide-ranging area. The volume is divided into three sections. The first deals with climatology, the second with socio-economic aspects, and the third with water resource design and practice. Considered are: (1) water supply and the future climate; (2) the interpretation of past climatic variability from paleoenvironmental indicators; (3) methods for estimating and projecting water demands; (4) climatic change and water law; (5) identification of economic and societal impacts of water shortages; (6) water resources systems planning; (7) water supply sensitivity of the Northeast to climatic change; and (8) impact on the Colorado River basin and Southwest water supply. Utilized are techniques such as transfer-function analysis, linear programming, and demand estimation. (See W79-03528 and W79-03529) (Bell-Graf-Cornell) W79-03527

#### WATER-RESOURCE SYSTEMS PLANNING

Geological Survey, Reston, VA.

For primary bibliographic entry see Field 6B.

W79-03528

#### METHODS FOR ESTIMATING AND PROJECTING WATER DEMANDS FOR WATER-RESOURCE PLANNING

California Univ., Riverside.

For primary bibliographic entry see Field 6D.

W79-03529

#### METEOROLOGICAL ANALYSIS OF AN OAHU FLOOD

Hawaii Univ., Honolulu. Dept. of Meteorology.

For primary bibliographic entry see Field 2E.

W79-03580

#### SOME EFFECTS OF SOIL SURFACE COVER ON INFILTRATION

Auburn Univ., AL.

For primary bibliographic entry see Field 2G.

W79-03676

#### DERIVATION OF EQUATIONS FOR VARIABLE RAINFALL INFILTRATION

Colorado State Univ., Fort Collins. Dept. of Civil Engineering.

For primary bibliographic entry see Field 2G.

W79-03681

#### CLIMATOLOGICAL AND PHYSICAL CHARACTERISTICS AFFECTING AVIAN POPULATION ESTIMATES IN SOUTHWESTERN RIVERIAN COMMUNITIES USING TRANSECT COUNTS

Arizona State Univ., Tempe. Dept. of Zoology; and Arizona State Univ., Tempe. Center for Environmental Studies.

B. W. Anderson, and R. D. Ohmart.

In: Importance, Preservation and Management of Riparian Habitat: A Symposium, July 9, 1977, Tucson, Arizona. USDA Forest Service General Technical Report RM-43, p. 193-200. 2 fig, 6 tab, 2 ref.

Field 2—WATER CYCLE  
Group 2B—Precipitation

Descriptors: \*Birds, \*Census, Climates, \*Methodology, Southwest U.S., Colorado River, Riparian land, Winds, Seasonal, Wetlands, Rivers, Mesquite.

Comparative data from about 20,000 censuses of line transects on the lower Colorado River show that strong winds (20 to 50 mph) may reduce censusing accuracy but winds below 20 mph appear not to strongly influence avian estimates. In winter, optimum censusing time is from 1 hour after sunrise to 2.5 hours after sunrise, whereas in summer, the optimum period is 0.25 hours before sunrise to 1 hour after sunup. Consecutive censuses from the same area by highly experienced observers (> 5 years of birding) are more consistent than less experienced personnel (10 to 16 months of birding). Each transect should be censused at least twice monthly for minimum best density estimates and three times for maximum best density estimates and three times for minimum best avian species diversity estimates. Four census reveal a greater number of species than with two or three censuses. Number of transects needed for a minimum adequate sample of 3,200 ha of mature honey mesquite (*Prosopis juliflora*) habitat is four (sampled three times monthly) but for more precise population data for each species six to nine are required. (Stihler-Mass)  
W79-03726

DISPLACEMENT OF SOIL WATER BY SIMULATED RAINFALL, Kentucky Agricultural Experiment Station, Lexington.

For primary bibliographic entry see Field 2G. W79-03799

NWS'S FLASH FLOOD WARNING AND DISASTER PREPAREDNESS PROGRAMS, National Weather Service, Silver Spring, MD. Disaster Preparedness Staff.

For primary bibliographic entry see Field 6F. W79-03816

## 2C. Snow, Ice, and Frost

SOIL - MOISTURE - TEMPERATURE FOR ALASKAN LOWLAND, Alaska Univ., Fairbanks.

G. L. Guymon. Journal of Irrigation and Drainage Division, ASCE, Vol. 101, No. IR3, p 187-199, September 1975. 5 fig, 13 ref. OWRT C-4049(No 9010)(2).

Descriptors: Soil investigations, \*Permafrost, \*Alaska, \*Soil types, \*Frozen soils, \*Soil moisture, Soil moisture meters, \*Soil temperature, Soil water movement, Soil profiles, Frost, On site investigations, Soil pressure, Pore pressure.

Field work was conducted at four sites in Goldstream Valley north of Fairbanks, Alaska, to obtain soilwater pressure and temperature data from (1) a lowland suprapermafrost soil adjacent to a stream, and (2) a lowland tussock soil underlain by shallow permafrost. Instrumentation at the sites consisted of tensiometer arrays for measuring pore-water pressures in the unsaturated soil zone, thermistor arrays for recording soil temperatures, and probes to determine frost depths. Data analysis shows that the annual soil-moisture and temperature patterns are a complex sequence of events. Soil-moisture-temperature relationships are discussed for summer, winter and spring. It is concluded that moisture movement in soils of extremely cold climates is a complex and dynamic process during the winter freezing period. (Davison-IPA)  
W79-03582

## PHYSICAL METHODS OF STUDYING ICE AND SNOW,

Army Terrestrial Science Center, Hanover, NH. Available from the National Technical Information Service, Springfield, VA 22161 as AD-A030 818. Prices codes: A11 in paper copy, A01 in microfiche. CRREL Draft Translation 539, August 1976. 246 p. Translated from *Trudy Arkhicheskii i An-*

*tarkhicheskii Nauchno-Issledovatel'skii Institute, Leningrad (USSR)*, Vol. 326, 1975. 228 p. V.V. Bogorodskiy, and V.P. Gavrilov, editors.

Descriptors: \*Remote sensing, \*Ice, \*Sea ice, \*Snow, Ice cover, Snow cover, Surveys, Instrumentation, Equipment, Radio, Radio waves, Radiation, Acoustics, Sounding, Strength of materials, Structures, Mechanical properties, Physical properties, Cold regions, Cold weather construction, \*Conferences, \*USSR, Ice breakup.

Proceedings of a scientific symposium organized by the Order of Lenin Arctic and Antarctic Scientific Research Institute and the International Commission for Antarctic Research, Earth Sciences Section, Presidium of the USSR Academy of Sciences, which was held in Leningrad on 1-5 October 1973, were published in this anthology. These articles by Soviet and foreign scientists reflect the results of research conducted in recent years on the following directions: (1) electromagnetic methods for analyzing snow and ice, active and passive radar analysis of ice and snow cover; (2) optical methods for analyzing snow, ice, and water; and (3) dynamic and static methods for analyzing the mechanical properties of ice and snow. (See also W79-03597 thru W79-03633) (Sims-ISWS)  
W79-03596

## RADIOPHYSICAL METHODS FOR ANALYZING ICE AND SNOW,

V. V. Bogorodskiy.

In: *Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire*, p 4-11, August 1976. 2 fig, 1 tab, 6 ref.

Descriptors: \*Remote sensing, \*Ice cover, \*Glaciers, Radio waves, Light, Physical properties, Topography, Topography mapping, Sea ice, Ice, Maps, Glaciology, \*USSR, Subglacial relief.

The present state of problems in ice and snow and the present state of problems in ice and snow physics that have been solved or are presently being solved by radiophysical methods of analysis was discussed. Special attention was devoted to research on electromagnetic characteristics of various types of ice and to radio sounding of ice cover, radio thermolocation of ice and snow cover, ice optics, and the mechanical characteristics of ice. Problems pertaining to the stressed state of ice cover, including research on glacier movement parameters, were examined. (See also W79-03596) (Sims-ISWS)  
W79-03597

## FM RADAR SIGNALS REFLECTED FROM ICE SURFACES, AND THE POSSIBILITIES FOR MODELING THEM,

A. B. Babayev, V. P. Logachev, V. N. Parfen'yev, V. A. Fedorov, and G. P. Shelomanova.

In: *Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire*, p 12-16, August 1976. 1 fig, 1 tab, 2 ref.

Descriptors: \*Remote sensing, \*Ice, \*Ice cover, \*Radio waves, Model studies, Mathematical models, Sea ice, Lake ice, Surface waters, Freshwater, Reflectance, Electrical properties, Engineering, Electrical engineering.

Properties of FM signals reflected from ice surfaces were analyzed on the basis of theoretical and experimental data. The electrophysical properties of ice and its roughness were taken into account. The possibility of modeling such a signal under laboratory conditions was examined. Possibilities were established for obtaining information on ice thickness using an FM signal. (See also W79-0396) (Sims-ISWS)  
W79-03598

EFFECT OF ICE STRUCTURE ON ITS RADIATION CHARACTERISTICS IN THE SHF RANGE, A. Ye. Basharinov, and A. A. Kurskaya.

In: *Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire*, p 17-19, August 1976. 1 fig, 4 ref.

Descriptors: \*Ice, \*Remote sensing, \*Radio waves, Ice cover, Radiation, Thermal radiation, Microwaves, Model studies, Mathematical models, On-site investigations, On-site data collections, Sea ice, Glaciers, Radiothermal emission.

Observed data were compared with model computations permitting evaluation of the porosity of an ice layer. In relation to the measured spectrums of the emissivity of polar sea ice, the ice porosity was assessed at an air inclusion concentration of 50-100 cu cm. Data from radiation measurements showed that the concentration of air inclusions in young ice does not exceed 5-15 cu cm. The observed abnormalities in the shape of the radiothermal emission spectrum of shelf ice on antarctica, manifesting themselves as a reduction in blackness in the centimeter range, were explained by a model of an ice layer containing water lenses. (See also W79-03596) (Sims-ISWS)  
W79-03599

## PROPAGATION OF RADIO WAVES IN GLACIERS,

V. V. Bogorodskiy, G. V. Trepov, and B. A. Fedorov.

In: *Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire*, p 20-25, August 1976.

Descriptors: \*Radio waves, \*Radar, \*Glaciers, \*Remote sensing, Electromagnetic waves, Ice, Ice cover, Model studies, Analytical techniques, Glaciology, Electrical engineering, Polarization.

The components of radar signal attenuation stemming from focusing (defocusing) and depolarization were analyzed. Measurements of the intensity of reflected signals and analyses of fluctuations in their intensity as well as analyses of depolarization phenomena in signals propagating through a glacier were discussed. (See also W79-03596) (Sims-ISWS)  
W79-03600

## RADIO SOUNDING OF SEA ICE,

V. V. Bogorodskiy, and V. P. Tripol'nikov.

In: *Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire*, p 26-28, August 1976. 1 fig, 4 ref.

Descriptors: \*Sea ice, \*Sounding, \*Radio waves, Laboratory tests, On-site investigations, Electromagnetic waves, Ice, Snow cover, Remote sensing, Physical properties, Ice-water interfaces, Signal velocity, Wave velocity.

Analysis of the electromagnetic characteristics of sea ice in the 40-440 MHz range demonstrated the promise of using this range for radar sounding of sea ice. Representation of the velocity of a radar signal in sea ice is a significant aspect of this problem. It was demonstrated with artificial samples of sea ice that the velocity of electromagnetic waves in sea ice depends on the relative concentration of liquid and solid phases. Analysis of wave velocities in natural sea ice confirms this result. Therefore, when making radar surveys of sea ice thickness, the temperature conditions and classification of ice must be taken into account in parallel. (See also W79-03596) (Sims-ISWS)  
W79-03601

## EMISSIVITY OF ICE, TERRESTRIAL, AND SEA SURFACES MODELED BY STRATIFIED HETEROGENEOUS STRUCTURES,

V. V. Bogorodskiy, A. I. Koslov, and L. T. Tuchkov.

In: *Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire*, p 29-35, August 1976. 2 fig, 14 ref.

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## Snow, Ice, and Frost—Group 2C

**Descriptors:** \*Model studies, \*Mathematical models, \*Radio waves, \*Remote sensing, Ice, Oceans, Land, Electromagnetic waves, Radiation, Thermal radiation, Temperature, Radiothermal emission, Polarization, Radiant temperature.

Some electrodynamic models of terrestrial, sea, and ice surfaces were proposed and studied. The models were built by successive introduction of electric and geometric irregularities into a stratified structure, both at the interfaces and within it, leading to formation of models of four classes: (1) with surface electric irregularities; (2) with electric irregularities within the layer; (3) with geometric irregularities at the boundary; and (4) with internal geometric irregularities. Research on the emission characteristics of the examined models was presented to clarify the dependence between their radiant temperature and the electrophysical, geometric, and statistical properties; and recommendations were given on model selection. (See also W79-03596) (Sims-ISWS) W79-03602

## MEASUREMENT OF REFLECTED SIGNALS DURING RADAR SOUNDING IN A LARGE RANGE OF ANGLES,

Z. Klau Dzh.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 63-68, August 1976. 3 fig, 2 ref.

**Descriptors:** \*Remote sensing, \*Radar, \*Snow, \*Ice, \*Antarctic, Radio waves, Reflectance, Sounding, Ice cover, Snow cover, Glaciers, On-site investigations.

This article presented the results of an analysis of ray pattern in research on the nature of echo signal recordings made in a large range of angles. A description was given of three potential sources of error in measuring the reflection velocity of signals. Examples of detailed measurements of reflected signals in a broad range of angles in 1967 at the coast of eastern Antarctica and in 1970 in the vicinity of Byrd Station were presented. (See also W79-03596) (Sims-ISWS) W79-03603

## DEPOLARIZATION OF REFLECTED RADIO SIGNALS,

For primary bibliographic entry see Field 7B. W79-03604

## REMOTE MEASUREMENT OF THE THICKNESS OF SEA ICE BY RADAR METHODS,

For primary bibliographic entry see Field 7B. W79-03605

## ELECTRIC PROPERTIES OF ICE FORMED IN A VACUUM, AND THEIR RELATIONSHIP TO STRUCTURE,

A. K. Zhebrovskiy, G. M. Strakhovskiy, V. N. Nedostayev, and V. I. Stebin.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 52-55, August 1976. 1 fig, 1 ref.

**Descriptors:** \*Ice, \*Electrical properties, \*Laboratory tests, Crystals, Air pressure, Temperature, Crystal growth, Freezing, Particle size, Measurements, Dielectric permeability.

Experimental results obtained by measuring the dielectric permeability of samples of ice formed in a vacuum chamber were analyzed depending upon structure and vapor pressure (0.0001-0.01 torr) in a frequency range from 0 to 1,000 Hz. The dominant factor in relation to both pure ice and ice formed in a vacuum is the condition under which the ice forms. Ice formed out of the vapor phase consists of polycrystals with a fine-grained structure. Grain size varies within 0.2-0.3 micrometers. The size of the forming grains depends upon the water vapor pressure. As pressure increases, the size of the grains grows. Grain size has a considerable influence

on electric properties of ice obtained in a vacuum. Enlargement of grains by about two times causes approximately a 30% increase in dielectric permeability. (See also W79-03596) (Sims-ISWS) W79-03606

## ICE PRESSURE ON SEPARATELY STANDING SUPPORTS IN LABORATORY AND NATURAL TESTS,

S. A. Vershinin, Ye. M. Kopaygorodskiy, V. V. Panov, and Z. I. Shvayshaytyn.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 63-68, August 1976. 3 fig, 2 ref.

**Descriptors:** \*Sea ice, \*Laboratory tests, \*Optical properties, \*Salinity, Transmissivity, Light, Ice, Properties, Physical properties, Extinction factor, Transmission factor.

This article presented some results of laboratory and natural tests to determine the action of ice upon vertical supports of hydraulic engineering structures in the presence of moving ice fields. When planning hydraulic engineering structures, the size of the limiting load is taken into account by introduction of coefficient  $K$ , which varies from 1.5 to 7 depending on the geometric parameters of the structure and ice thickness. (See also W79-03596) (Sims-ISWS) W79-03607

## EFFECT OF SEA ICE SALINITY ON OPTICAL EXTINCTION AT WAVELENGTH 6,328 Å,

Kh. Devi, and R. M'yunis.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 63-68, August 1976. 3 fig, 2 ref.

**Descriptors:** \*Sea ice, \*Laboratory tests, \*Optical properties, \*Salinity, Transmissivity, Light, Ice, Properties, Physical properties, Extinction factor, Transmission factor.

The results of research on the dependence between the extinction factor and sea ice salinity were presented. Optical extinction factors were computed, and the dependence between the extinction factor and measured ice salinity was set up. An experiment revealed presence of an exponential dependence between the extinction factor and ice salinity. This dependence can be described by the formula  $y = 2.41 + 0.001 \exp(1.19x)$ , where  $y$  is the extinction factor and  $x$  is ice salinity. (See also W79-03596) (Sims-ISWS) W79-03608

## OPTICAL CHARACTERISTICS OF SOME VARIETIES OF NATURAL ICE,

B. Ya. Gayshokhi.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 69-72, August 1976. 1 fig, 2 ref.

**Descriptors:** \*Ice, \*Optical properties, \*Laboratory tests, Sea ice, Light, Energy transfer, Transmissivity, Reflectance, Properties, Physical properties, Transmission factor, Reflection factor, Ice types.

The results of experimental research on optical characteristics of sea and freshwater ice were examined. The diffuse transmission and reflection factors of ice samples were measured in some portions of the spectrum in the 360-1,000 nanometer wavelength range. The relative scattering indicatrix was determined at a wavelength of 6,328 Å. The dependence of optical characteristics on the structure and composition of natural ice was examined. (See also W79-03596) (Sims-ISWS) W79-03609

## INSTRUMENTS FOR ANALYZING SPECTRAL REFLECTION OF LIQUID WATER IN THE

## WAVELENGTH RANGE FROM 1 TO 50 MICRONS,

Vsesoyuznyi Elektrotehnicheskii Inst., Moscow (USSR). Dept. of the Fundamentals of Electronic Engineering.

For primary bibliographic entry see Field 7B. W79-03610

## THE PROBLEM OF STUDYING CHARGE GENERATION ON THE PHASE INTERFACE OF 0.001 MOLAR SODIUM CHLORIDE SOLUTION UNDERGOING DIRECTED FREEZING, V. Petera.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 79-87, August 1976. 4 fig, 1 tab, 9 ref.

**Descriptors:** \*Freezing, \*Aqueous solutions, \*Sodium chloride, Ions, Cations, Water, Ice, Solutes, Electrical properties, Electricity, Interfaces, Ice-water interfaces, Laboratory tests, Electric charge, Electric potential.

It was established through experimental analysis of freezing of NaCl solution that the positive electric potential arising in the solution above growing ice when the base of the vessel is grounded indicates that the quantity of anions in ice exceeds the quantity of cations. Electric equilibrium was attained in this case through compensation of excess chloride ions, as compared to the concentration of sodium ions, by hydrogen ions. The maximum electric potential was observed in the initial phases of directed freezing. (See also W79-03596) (Sims-ISWS) W79-03611

## BEHAVIOR OF ICE IN RAPIDLY VARYING HIGH INTENSITY ELECTROMAGNETIC FIELDS,

L. B. Nekrasov.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 88-91, August 1976. 8 ref.

**Descriptors:** \*Ice, \*Thin films, \*Water, \*Electromagnetic waves, Physical properties, Films, Nuclear magnetic resonance, Adsorption, Crystals, Properties, Laboratory tests, Ice properties, Ice behavior, Intense electromagnetic fields.

This work attempted to confirm existence of film water in monolithic poly-crystalline ice on the basis of its behavior in a rapidly varying high intensity electromagnetic field. Results were presented of experiments with samples of highly and weakly mineralized ice, as well as experiments with ice samples prepared from chemically pure water. It was established that in all cases the ice samples underwent intense breakup in response to a high frequency electric field (field frequency 40.68 MHz). The observed pattern of the breakup of ice practically devoid of impurities was explained. (See also W79-03596) (Sims-ISWS) W79-03612

## MAGNETIC SURVEY OF ICE WEDGES,

B. V. Volod'ko, V. S. Yakupov, E. N. Akhmedyanov, V. M. Kalinin, and V. O. Papitashvili.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 92-96, August 1976. 1 fig.

**Descriptors:** \*Permafrost, \*Ice, \*Surveys, \*Magnetic studies, Mapping, Locating, Boreholes, Soils, Rocks, Frozen ground, Geology, On-site investigations, Remote sensing, \*Ice wedges, Subterranean ice.

The results of a magnetic survey with a spacing of  $2 \times 2$  sq m, performed on a plot on Tyungylinskaya Terrace, were presented. It was demonstrated that there is no correlation between the pattern anomalies and the distribution of magnetic susceptibility of soil in area. Negative anomalies extend

## Field 2—WATER CYCLE

### Group 2C—Snow, Ice, and Frost

ing submeridionally and latitudinally, forming a system of polygons, were revealed clearly in plan-view isolines. Drilling data (29 boreholes) clearly confirmed correspondence of negative magnetic anomalies to ice wedges. (See also W79-03596) (Sims-ISWS) W79-03613

#### LOW FREQUENCY POLARIZATION OF ICE IN FROZEN COARSE-DISPERSION FORMATIONS.

V. P. Mel'nikov, and A. M. Snegirev.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 97-101, August 1976. 1 fig, 7 ref.

Descriptors: \*Permafrost, \*Ice, \*Remote sensing, Frozen ground, Electrodes, Electrical resistance, Temperature, Thawing, Rocks, Soils, On-site investigations, Laboratory tests, \*Ice wedges, Polarizability, Polarization.

The results of experimental laboratory and field studies on low frequency polarization of ion-conducting rock were discussed. It was demonstrated that polarizability can attain values greater than 20%. Even at a temperature of -14°C, such polarization attests to the presence of a phase boundary between ice and nonfreezing water. (See also W79-03596) (Sims-ISWS) W79-03614

#### COASTAL ICE DYNAMICS ACCORDING TO SLAR OBSERVATIONS,

For primary bibliographic entry see Field 7B.

W79-03615

#### SEA SURFACE TEMPERATURE OBSERVATIONS BY A RADIATION THERMOMETER ABOARD AN ICE RECONNAISSANCE AIRCRAFT.

For primary bibliographic entry see Field 7B.

W79-03616

#### USE OF ACOUSTIC METHODS TO ANALYZE SNOW AND ICE.

For primary bibliographic entry see Field 7B.

W79-03617

#### ATTENUATION AND SCATTERING OF SOUND WAVES BY SEA ICE,

For primary bibliographic entry see Field 7B.

W79-03618

#### ONE METHOD FOR MEASURING SOUND ATTENUATION IN NATURAL ICE,

For primary bibliographic entry see Field 7B.

W79-03619

#### SEISMIC AND TILT METER METHODS FOR ANALYZING ICE COVER,

For primary bibliographic entry see Field 7B.

W79-03620

#### ANALYSIS OF GLACIER DYNAMICS USING A LASER DEFORMOGRAPH,

I. M. Belousova, I. P. Ivanov, and N. G. Firsov.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 140-143, August 1976. 1 fig, 4 ref.

Descriptors: \*Glaciers, \*Movement, \*Remote sensing, \*Instrumentation, \*Antarctic, Deformation, Equipment, Measurement, On-site investigations, Laboratory tests, Light, Ice, Ice cover, Glaciology, \*Lasers, Laser deformographs.

The characteristics of a laser deformograph intended for remote determination of the rate of movement and deformation of glaciers were discussed. The design of the instrument and the optical system, which include a helium-neon laser, a re-

ceiving-transmitting telescope, and a high precision triple prism reflector, permitted measurement of deformations of 0.1-1 micron/sec at a range of up to 2 km. Experimental data were presented from measured instantaneous rates of movements of glaciers on Antarctica. (See also W79-03596) (Sims-ISWS) W79-03621

#### EXPERIMENTAL STUDY OF ICE ADHESION IN THE LABORATORY AND IN SITU,

V. V. Panov, A. V. Panyushkin, Yu. D. Sinochkin, and Z. I. Shvayshayen.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 144-152, August 1976. 2 fig, 1 tab.

Descriptors: \*Ice, \*Mechanical properties, \*Instrumentation, \*Laboratory tests, On-site investigations, Loads(Forces), Physical properties, Artificial substrates, Surfaces, Salinity, Temperature, \*Ice adhesion, Free surface energy.

This article examined original instruments and a procedure for determining adhesion of ice to construction materials and coatings in laboratory and field conditions. Also discussed were the results of experiments in which the effect of various factors on adhesion was studied. Semi-empirical relationships were obtained for computation of adhesive force and consideration of the effect of temperature and salinity on this variable. (See also W79-03596) (Sims-ISWS) W79-03622

#### ANALYSIS OF THE ICE LAYER BREAKDOWN PROCESS,

N. A. Grubnik, V. I. Fomin, and A. B. Shemyakin.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 153-154, August 1976. 1 fig.

Descriptors: \*Ice, \*Mechanical properties, \*Laboratory tests, Physical properties, Tensile strength, Elasticity(Mechanical), Flexibility, Vibrations, Strength, Stress, Strength of materials, Ice breakdown, Metallic surfaces, Modulus of elasticity, Breakdown processes.

The modulus of elasticity of ice on a metallic surface was determined by the resonant method of flexural oscillations. Breakup of ice in response to longitudinal oscillations of a metallic rod with ice frozen onto it and in response to flexural oscillations of a plate bearing ice was described. A dependence was revealed between the amplitude of plate sag at which ice begins to break up and various factors. (See also W79-03596) (Sims-ISWS) W79-03623

#### MECHANICAL PROPERTIES OF SNOW AS A CONSTRUCTION MATERIAL,

For primary bibliographic entry see Field 8G.

W79-03624

#### ARCTIC SNOW COVER,

I. M. Dolgin, N. N. Bryazgin, and L. S. Petrov.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 163-168, August 1976. 2 fig, 2 tab, 5 ref.

Descriptors: \*Snow cover, \*Arctic, \*Mapping, \*Variability, Depth, Density, Snowfall, Snow, Storms, Albedo, Thawing, Melting, Seasonal, Climatology.

Maps of maximum height and persistence of snow cover and of the times of snow formation and disintegration were plotted on the basis of arctic snow cover research performed by the AANII. Great variability of the height of snow cover and its other characteristics was established. (See also W79-03596) (Sims-ISWS) W79-03625

#### A METHOD FOR MEASURING HIGH MOISTURE RESERVES IN SNOW COVER USING COSMIC RADIATION,

For primary bibliographic entry see Field 7B. W79-03626

#### METHODS FOR MEASURING THE STRENGTH CHARACTERISTICS OF NATURAL AND PROCESSED SNOW,

For primary bibliographic entry see Field 8G. W79-03627

#### STATISTICAL EVALUATION OF THE SPATIAL DISTRIBUTION OF THE PRINCIPAL ICE COVER PARAMETERS,

A. Ya. Buzuyev.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 185-190, August 1976. 2 fig, 8 ref.

Descriptors: \*Ice, \*Ice cover, \*Spatial distribution, \*Statistics, Measurement, Data processing, Snow, Snow cover, Glaciers, Glaciology, \*Ice thickness.

Correlation functions for distribution of thicknesses of ice of different ages were obtained through statistical treatment of measurements; it was demonstrated that the distribution of thicknesses of ice and heights of snow was described satisfactorily by a (Sharlye) function. (See also W79-03596) (Sims-ISWS) W79-03628

#### ANALYSIS OF THE MECHANICAL PROPERTIES OF FRESHWATER ICE IN THE PRESENCE OF SLOW LOAD CHANGES,

K. N. Korzhavin, and A. B. Ivchenko.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 191-195, August 1976. 1 fig, 10 ref.

Descriptors: \*Ice, \*Lake ice, \*Mechanical properties, \*Model studies, Mathematical models, Theoretical analysis, Loads(Forces), Ice loads, Stress, Deformation, Strength, Temperature, Analytical techniques, Rheology, Freshwater ice.

A rheological model describing behavior of ice under a load was selected on the basis of experimental data on the correlation between ice deformation and stress in combination with information on the structure of polycrystalline ice. A rheological equation describing changes in shape in the presence of nonlinear correlation between deformation and stresses for most elements composing the model was obtained for the proposed model. The problem of the stressed state of ice cover in response to temperature change was solved theoretically. The rheological model can be used to solve various problems. The possibility for improving the model as data on structure of ice and its behavior under a load are accumulated is important. (See also W79-03596) (Sims-ISWS) W79-03629

#### SHORT-TERM ICE CREEP AND MICRO-CRACK FORMATION KINETICS,

Yu. K. Zaretskiy, A. M. Fish, V. P. Gavrilov, and A. V. Gusev.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 196-203, August 1976. 4 fig, 4 ref.

Descriptors: \*Ice, \*Mechanical properties, \*Creep, \*Cracks, Stress, Loads(Forces), Ice loads, Deformation, Compressive strength, Acoustics, Elasticity(Mechanical), Model studies, Laboratory tests, Mathematical models, Kinetics, Rheology, Ice breakup.

The results of research on short-term creep of freshwater ice samples subjected to single-axis compression were presented. Acoustic emissions accompanying deformation of ice under stress

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## Streamflow and Runoff—Group 2E

October 1978. 6 fig, 3 tab, 2 ref.

Descriptors: \*Evaporation, \*Sands, \*Water table, Diurnal distribution, Arid climates, Arid lands, Radiation, Condensation, Lysimeters, Temperature, Variability, Vapor pressure, \*Sand tanks, \*Diurnal evaluation, Diurnal variation, Diurnal peak, Condensation surface, Evaporation tanks, Vapor pressure deficit.

Evaporation from sand tanks in an arid climate was estimated by measuring the amount of water needed to maintain the water table at a prescribed fixed level. In earlier experiments, two peaks were found, one in the afternoon and the other at sunrise. To obtain more reliable information on the phenomenon of the peak at sunrise, hourly data were evaluated from an evaporation experiment which lasted 847 days. The results of 518 days were used for a diurnal evaluation. It was confirmed that two peaks occurred during a 24-hour period. One peak was related to radiation, and the deeper the water table was kept below the sand surface, the later the peak occurred. This was the absolute diurnal peak for those tanks in which the sand surface was never dry. It was a relative diurnal peak for those tanks in which the sand surface was normally dry. The other peak appeared at sunrise and was related to the air temperature. This peak was independent of the depth of the water table up to a depth of 400 mm below the sand surface. Down to a water table of 600 mm below the sand surface, the time lag at which this peak occurred relative to the lowest air temperature increased for up to 2 hours. This peak was a relative diurnal peak for those tanks in which the sand surface was never dry. It was the absolute diurnal peak for those tanks in which the sand surface was normally dry. It appeared as if the evaporation peak at sunrise depended on the presence of a condensation surface. (See also W74-11267, W74-11266, W74-07169, W73-07056 and W73-07055) (Roberts-ISWS)

W79-03960

## 2E. Streamflow and Runoff

## SIMULATION PROCEDURES FOR BOX-JENKINS MODELS

University of Western Ontario, London.  
A. I. McLeod, and K. W. Hipel.  
Water Resources Research, Vol 14, No 5, p 969-975, October 1978. 2 tab, 35 ref.

Descriptors: \*Simulation analysis, \*Synthetic hydrology, \*Reservoir design, \*Model studies, \*Algorithms, \*Parametric uncertainty, \*Box-Jenkins model, Stochastic processes, Computer models, Computer programs, Equations, Hydrologic data, Systems analysis.

New simulation procedures are presented for generating synthetic data from either a nonseasonal or a seasonal Box-Jenkins model. The simulation techniques are designed so that random realizations of the underlying stochastic process are employed for starting values. Because fixed beginning values are not utilized, systematic bias is not introduced into the synthetic trace. When the data have been transformed by a Box-Cox transformation, the inverse transformation can be conveniently incorporated into the simulation process. Also, a new algorithm is presented for simulating integrated models. A method is developed for incorporating parameter uncertainty into simulation studies, and it is explained how this technique can be used in the design of reservoirs. Practical applications are presented to demonstrate the efficacy of the aforesaid simulation methods. In addition, the Fortran computer subroutines for the simulation procedures are included in an appendix with the microfiche edition of this paper. (Bell-Cornell)

W79-03523

## METEOROLOGICAL ANALYSIS OF AN OAHU FLOOD

Hawaii Univ., Honolulu. Dept. of Meteorology.  
T. A. Schroeder.  
Monthly Weather Review, Vol. 105, No. 4, p 458-

were recorded in experiments. This permitted the authors to reveal the micromechanism behind short-term creep, to provide a physical interpretation of the limit of long-term strength, and to establish the criteria of ice breakup. The fundamental possibility of determining rheological properties of ice from acoustic emission data was demonstrated. (See also W79-03596) (Sims-ISWS)

W79-03630

## FIELD ANALYSES OF PHYSOCOMECHANICAL PROPERTIES OF ICE COVER,

A. Ya. Ryvlin.

In: *Physical Methods of Studying Ice and Snow*, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 204-209, August 1976. 2 fig, 2 tab.

Descriptors: \*Ice cover, \*Mechanical properties, \*Strength, Ice, Ice loads, Loads(Forces), Lake ice, Temperature, Salinity, Friction, Fluid friction, Roughness(Hydraulic), Physical properties, Yield strength, Data processing, Freshwater ice, Ice breakup.

This article generalized the results of experimental research on the limit of ice cover flexural strength and external ice friction, performed for a number of years on arctic seas and other freezing water basins in the country. Generalized data were presented on the magnitude of constants characterizing these physicomechanical properties of ice. Empirical computation formulas that can be used in practice to determine the limit of ice cover flexural strength were presented. (See also W79-03596) (Sims-ISWS)

W79-03631

## DETERMINATION OF SPECIFIC BREAKUP ENERGY AND CONTACT PRESSURES PRODUCED BY THE IMPACT OF A SOLID AGAINST ICE,

D. Ye. Kheysin, V. A. Likhomanov, and V. A. Kurdyumov.

In: *Physical Methods of Studying Ice and Snow*, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 210-219, August 1976. 3 fig, 6 ref.

Descriptors: \*Ice, \*Strength, \*Mechanical properties, \*On-site investigations, Energy, Data processing, Mathematical models, Equations, Loads(Forces), Ice loads, Velocity, Pressure, Elasticity(Mechanical), Physical properties, Strength of materials, Contact pressures, Impact(Mechanical), Ice breakup, Breakup energy.

Penetration of a solid into an ice surface upon impact was examined. A mathematical model of the penetration process was built on the basis of data from special experiments. This model was used to determine contact pressures in the zone of impact. Maximum contact pressures averaged over the area of the zone of contact turned out to be directly proportional to the unit fractionation energy of ice, which was known from experiments. (See also W79-03596) (Sims-ISWS)

W79-03632

## A RADIO HYDROACOUSTIC METHOD FOR ANALYZING MODERATE-RANGE CHARACTERISTICS OF SEA ICE DYNAMICS,

For primary bibliographic entry see Field 7B.

W79-03633

## EARLY DEGLACIATION OF THE LABRADOR SHELF,

Bedford Inst. of Oceanography, Dartmouth (Nova Scotia), Atlantic Geoscience Center.

G. Vilks, and P. J. Mudie.

Science, Vol 202, No 4373, p 1181-1183, December 15, 1978. 2 fig, 1 tab, 24 ref.

Descriptors: \*Paleoclimatology, \*Glaciers, \*Continental shelf, \*Atlantic Ocean, Coasts, Sediments, Bottom sediments, Cores, Core logging, Pollen, Core drilling, Subarctic, Cold regions, Glaciology, \*Labrador shelf, Deglaciation.

Two marine sediment cores from a basin on the southeastern Labrador Shelf penetrated a mud sequence extending back to 21,000 carbon-14 years before the present (B.P.). The benthic foraminifera were dominated by subarctic nearshore species indicative of ice-free summer waters. The pollen record indicated the presence of a sedge-shrub tundra in eastern Labrador as early as 21,000 years B.P. Both sources of evidence suggested less extensive continental ice than has been reported previously for this subarctic region. (Sims-ISWS)

W79-03814

## DYNAMICS OF AN ICE COVERED LAKE WITH THROUGH-FLOW,

Goteborg Univ. (Sweden). Dept. of Oceanography.

For primary bibliographic entry see Field 2H.  
W79-03898

## 2D. Evaporation and Transpiration

## ESTIMATING GROUNDWATER RECHARGE FROM CONSERVATION BENCH TERRACES,

Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.

For primary bibliographic entry see Field 2F.

W79-03692

## ACTUAL EVAPOTRANSPIRATION OVER A SUMMER PERIOD IN THE 'HUPSEL CATCHMENT',

Agricultural Univ., Wageningen (Netherlands). Dept. of Hydraulics and Catchment Hydrology. H. Stricker, and W. Brutsaert.

Journal of Hydrology, Vol. 39, No. 1/2, p 139-157, October 1978. 7 fig, 6 tab, 13 ref.

Descriptors: \*Evapotranspiration, \*On-site investigations, \*Model studies, Mathematical models, Temperature, Air temperature, Winds, Radiation, Humidity, Rainfall, Evaporation, Energy budget, Measurement, Vegetation, Land use, Agriculture, Watersheds(Basins), Heat transfer, \*Netherlands.

Actual evapotranspiration was determined in a rural catchment, 'Hupselse Beek', situated in a sandy region in the eastern part of the province of Gelderland, in The Netherlands; the experiment covered a period of nearly 80 days in the summer of 1976, during which a severe drought was experienced in western Europe. Actual evapotranspiration was obtained indirectly by the energy budget on an hourly basis, in which the sensible heat flux was calculated from the mean temperature profile and the wind speed. The sensitivity of the results was analyzed for the choice of the roughness and the zero-plane displacement height in the wind profile, and for errors in the measured temperatures. The calculated results were quite insensitive to the exact formulation of the Monin-Obukhov functions for the mean wind and temperature profiles. However, it was found that the effect of non-neutral atmospheric conditions cannot be neglected; the effect of the buoyancy due to water-vapor stratification on the overall stability of the atmosphere was also noticeable. A comparison with a measure of potential evapotranspiration showed that the actual evapotranspiration was far from the potential. (Sims-ISWS)

W79-03813

## RADIATION AND ENERGY BALANCE OF A TRICKLE-IRRIGATED LEMON GROVE,

Arizona Water Resources Research Center, Tucson.

For primary bibliographic entry see Field 3F.

W79-03828

## EVAPORATION OF WATER FROM SAND, 6. THE INFLUENCE OF THE WATER TABLE ON DIURNAL VARIATIONS,

National Inst. for Water Research, Windhoek (South West Africa).

D. H. R. Hellwig.

Journal of Hydrology, Vol 39, No 1/2, p 129-138.

## Field 2—WATER CYCLE

### Group 2E—Streamflow and Runoff

468, April 1977. 14 fig, 2 tab, 10 ref. OWRT A-062-HI(2).

Descriptors: \*Flood data, \*Oahu, \*Thunderstorms, \*Synoptic analysis, Weather data, Rain, Weather patterns, Rainfall intensity, Rainfall-runoff relationships, Instrumentation, Rain gages, Networks, Stream gages, Hawaii.

Results of a detailed study of the severe rainstorm on the island of Oahu, Hawaii, on April 19, 1974 are reported. Weather conditions leading to flood conditions in Hawaii have been classified as: (1) upper tropospheric troughs which overlie surface trade winds in any season; (2) cold fronts penetrating Hawaii from midlatitudes; (3) Kona lows developing west of the islands during the winter; and (4) tropical cyclones. The storm under study resulted from the first condition. Examinations of the extensive rain gage system on Oahu were made to determine the mesoscale structures of the precipitating cloud systems. From a study of special rain and stream gage network in Moanalua Valley it was concluded that the existing Hawaiian flood detection system is inadequate. Information obtained from the rain gages was incorporated with available meteorological observations, and a conceptual model of the flood producing system for this storm was constructed. It was concluded that the mountainous terrain of the area is a major element in the persistence of thunderstorm activity. (Davison-IPA)

W79-03580

### 2F. Groundwater

#### FRESH GROUNDWATER BENEATH CONTINENTAL SHELF: FINDINGS OF ATLANTIC CONTINENTAL-MARGIN DRILLING PROGRAM,

Geological Survey, Woods Hole, MA. Water Resources Div.

For primary bibliographic entry see Field 1A.

W79-03562

#### NOTES ON A SERIES REPRESENTATION OF THE LEAKY AQUIFER WELL FUNCTION,

Nevada Univ. System, Las Vegas. Water Resources Center.

C. M. Case, and J. C. Addiego.

Journal of Hydrology, Vol. 32, p 393-397, 1977. ref. OWRT A-059-NEV(4).

Descriptors: \*Aquifers, \*Wells, \*Mathematical studies, Equations, \*Leaky aquifers.

A simple series representation of the leaky aquifer well function is presented. Fairly rapid computations of  $W(u, r/L)$  to a high precision for a wide range of values of  $u$  and  $r/L$ . Representative values of  $W(u, r/L)$  computed using 20 terms of the series of eq. 9 are tabulated. (Davison-IPA)

W79-03588

#### ORIGIN OF FRESH GROUND WATER BENEATH THE U.S. ATLANTIC CONTINENTAL SHELF,

Geological Survey, Woods Hole, MA. Water Resources Div.

For primary bibliographic entry see Field 1A.

W79-03589

#### RECHARGE AND GROUNDWATER CONDITIONS IN THE WESTERN REGION OF THE ROSWELL BASIN,

New Mexico Inst. of Mining and Technology, Socorro. Dept. of Geosciences.

C. Duffy, L. W. Gelhar, and G. W. Gross.

Available from the National Technical Information Service, Springfield, VA. 22161 as PB-290 577, Price codes: A07 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces Report No. 100 Partial Technical Completion Report, 1978, 111 p, 18 fig, 21 tab, 29 ref, 2 append. OWRT A-055-NMEX(1), 14-34-0001-6032.

Descriptors: \*Groundwater, \*Groundwater recharge, Groundwater movement, \*Surface-Groundwater relationships, Synthetic hydrology, Stochastic processes, Tritium, Aquifers, Springs, Wells, Streams, \*Roswell Basin(N MEX), \*New Mexico, \*Yoso aquifer(NMEX), \*Glorieta aquifer(NMEX).

An examination of recharge and groundwater conditions of the western region of the Roswell basin is presented. Recharge mechanisms are proposed on the basis of several long record observation wells. Water levels with long trends are associated with recharge from areal precipitation. It is thought that several years of above average rainfall are necessary to increase groundwater storage significantly. A fluctuating cyclic response is associated with channel leakage from streams in the study area. This recharge mechanism was verified using a stochastic stream-aquifer model applied to the Rio Hondo and Rio Penasco drainages. With this model, channel leakage and aquifer parameters could be estimated. The two types of water level response are associated with characteristic tritium levels. High tritium levels in wells near streams verify a fast recharge component indicated by the model. For wells not located near streams in the intake area and for wells in the Principal Aquifer, low tritium values are found. These wells indicate longer residence times than previously suggested. It seems likely that precipitation on the region outside the Principal Intake Area supplies a significant portion of total recharge to the Principal Aquifer. (Stockton-N Mex)

W79-03663

#### FRESH GROUND WATER FOUND DEEP BENEATH NANTUCKET ISLAND, MASSACHUSETTS,

Geological Survey, Woods Hole, MA. Water Resources Div.; and Geological Survey, Boston, MA. Water Resources Div.

For primary bibliographic entry see Field 1A.

W79-03690

#### ESTIMATING GROUNDWATER RECHARGE FROM CONSERVATION BENCH TERRACES,

Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.

W. H. Neibing.

Master's Thesis, 1976. 133 p, 19 fig, 19 tab. OWRT A-068-Kan(1).

Descriptors: Hydrologic aspects, \*Groundwater recharge, \*Evapotranspiration, Meteorological data, Weather data, Computer models, Crop rotations, Soil properties, Soil moisture, Drainage effects, Soil types, Loam, Silts, Watersheds(Basins), Terraces(Agricultural), Water conservation, Natural recharge.

In determining the potential for groundwater recharge from conservation beach terraces a continuous water-budget type computer model was developed. Inputs or crop and soil moisture properties, and daily weather observations were used to calculate daily potential evapotranspiration, actual evapotranspiration and soil moisture changes in a 213 cm soil profile. Laboratory tests were conducted to determine the relationships of soil water potential-soil water content, and unsaturated hydraulic conductivity-soil water content for the silt loam soil in the conservation bench terrace area study. The water budget model utilized these relationships in calculating daily soil water movement across the 183 cm depth boundary. Weather records from 1945 through 1974 were used to make computer runs containing four model combinations or crop rotations and watershed: bench ratios utilized on the conservation bench terraces. Wheat-fallow rotation runs were made for the watershed areas, ad either wheat-fallow or continuous grain sorghum rotation runs were made on the benches. All bench areas showed a larger recharge rate than was calculated for the sloping watershed conditions. It is concluded that conservation bench terraces have the potential for ground water recharge when used on the type of soil studied; the effectiveness of the recharge structure is dependent on

the choice of crop rotations and watershed: bench area ratio. (Davison-IPA)

W79-03692

#### HANDBOOK FOR HYDROGEOLOGISTS, VOLUME I, (SPRAVOCHNOE RUKO- VODSTVO GIDROGEOLOGA).

For primary bibliographic entry see Field 4B.

W79-03798

#### ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN LYNN AND GRAZA COUNTIES, TEXAS. PROJECTIONS OF SATURATED THICKNESS, VOLUME OF WATER IN STORAGE, PUMPAGE RATES, PUMPING LIFTS, AND WELL YIELDS,

Texas Dept. of Water Resources, Austin.

For primary bibliographic entry see Field 4B.

W79-03818

#### CONTRIBUTIONS TO THE HYDROGEOLOGY OF ALBERTA.

Alberta Research Council, Edmonton. Ground-water Div.

Bulletin 35, 1977. 101 p, 55.00.

Descriptors: \*Groundwater, \*Canada, \*Hydrogeology, \*Water chemistry, \*Mapping, Model studies, Aquifers, Aquifer characteristics, Drawdown, Wells, Water wells, Transmissivity, Permeability, Pumping, Chemicals, Surveys, Sampling, Geology, Tunnels, Computer programs, Hydrology.

Seven papers relating to the hydrogeology of Alberta, Canada, were included. Topics covered were hydrogeologic mapping, water chemical sampling, pumping tests, drawdown, dewatering, and groundwater modelling. Although all the work reported was related to Alberta, many of the techniques described should be useful in other locations. (See W79-03820 thru W79-03826) (Sims-ISWS)

W79-03819

#### THE HYDROGEOLOGICAL RECONNAISSANCE MAPS OF ALBERTA,

Alberta Research Council, Edmonton. Ground-water Div.

For primary bibliographic entry see Field 7C.

W79-03820

#### APPARENT TRANSMISSIVITY AND ITS DETERMINATION BY NOMOGRAM,

Alberta Research Council, Edmonton. Ground-water Div.

G. F. Ozoray.

In: Contributions to the Hydrogeology of Alberta, Bulletin 35. Alberta Research Council, Edmonton, p 13-17, 1977. 2 fig, 6 ref.

Descriptors: \*Groundwater, \*Transmissivity, \*Equations, Pumping, Drawdown, Geology, Hydrogeology, Hydraulic conductivity, Aquifers, Aquifer characteristics, Permeability, Hydrology, \*Nomograms.

Apparent transmissivity values can provide a valuable indication of regional variations in relevant rock properties. Apparent transmissivity was calculated from the duration and rate of pumping (bailing) and from the resulting total drawdown. Graphically, a straight line was substituted for the real drawdown curve, and the starting point of the time scale was arbitrarily selected as 0.1 minute (because 0 cannot be represented on the semilog paper). By definition, apparent transmissivity was then calculated with Jacob's modified non-equilibrium formula as follows:  $T(\text{app}) = 264 Q \log(10 t)/s$  where:  $T(\text{app})$  = apparent transmissivity in imperial gallons/day/foot (igpd/ft);  $Q$  = pumping or bailing in imperial gallons/minute (igpm);  $s$  = total drawdown in feet; and  $t$  = total duration of pumping or bailing in minutes. A nomogram was presented which facilitates quick graphic determination of apparent transmissivity. The construction of the nomogram was explained, and practical

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## WATER CYCLE—Field 2

### Water In Soils—Group 2G

examples were given for its use. (See also W79-03819)(Sims-ISWS)  
W79-03821

**SAMPLING OF GROUNDWATERS FOR CHEMICAL ANALYSIS,**  
Alberta Research Council, Edmonton. Groundwater Div.  
For primary bibliographic entry see Field 2K.  
W79-03822

**CHARACTERISTICS OF PUMPING TESTS CONDUCTED IN HETEROGENEOUS CLASTIC SEDIMENTS OF THE EDMONTON AREA, ALBERTA,**  
Alberta Research Council, Edmonton. Groundwater Div.  
For primary bibliographic entry see Field 4B.  
W79-03823

**INVESTIGATION OF THE FEASIBILITY OF DEWATERING BURIED VALLEY SANDS TO AID SEWER-TUNNEL EXCAVATIONS, EDMONTON, ALBERTA,**  
Alberta Research Council, Edmonton. Groundwater Div.  
For primary bibliographic entry see Field 8D.  
W79-03824

**TELEDELTOLOS MODELLING OF HOMOGENEOUS AND HETEROGENEOUS GROUNDWATER SYSTEMS,**  
Alberta Research Council, Edmonton. Groundwater Div.  
R. Stein.  
In: Contributions to the Hydrogeology of Alberta, Bulletin 35, Alberta Research Council, Edmonton, p 55-63, 1977. 3 fig, 5 ref.

Descriptors: \*Groundwater, \*Aquifers, \*Model studies, \*Analog models, Hydraulic conductivity, Permeability, Anisotropy, Aquifer characteristics, Analog computers, Analytical techniques, Finite element analysis, Groundwater movement, Hydrology, Hydrogeology.

Formal similarity between the laws governing flow of fluids in permeable media and electric currents allows subsurface fluid potential distributions to be modelled by electric analogy using a conductive medium such as Teledeltos paper. Such models can presently incorporate, to a certain extent, hydraulic conductivity variations both in direction and magnitude and play a useful role in the process of groundwater flow evaluation. (See also W79-03819) (Sims-ISWS)  
W79-03825

**DLSPLIT: A COMPUTER PROGRAM FOR TRANSLATING DOMINION LAND SURVEY COORDINATES TO UNIVERSAL TRANSVERSE MERCATOR COMPATIBLE COORDINATES,**  
Alberta Research Council, Edmonton. Groundwater Div.  
For primary bibliographic entry see Field 7C.  
W79-03826

**PUBLIC GROUNDWATER SUPPLIES IN HENDERSON COUNTY,**  
Illinois State Water Survey, Urbana.  
For primary bibliographic entry see Field 4B.  
W79-03827

**SOLUTE TRAVEL-TIME ESTIMATES FOR TILE-DRAINED FIELDS: III. REMOVAL OF A GEOTHERMAL BRINE SPILL FROM OIL BY LEACHING,**  
California Univ., Riverside. Dept. of Soil and Environmental Sciences.  
For primary bibliographic entry see Field 2G.  
W79-03961

### 2G. Water In Soils

**SOIL - MOISTURE - TEMPERATURE FOR ALASKAN LOWLAND,**  
Alaska Univ., Fairbanks.  
For primary bibliographic entry see Field 2C.  
W79-03582

**NITRATE ACCUMULATION IN SOILS AND LOSS IN TILE DRAINAGE FOLLOWING NITROGEN APPLICATIONS TO CONTINUOUS CORN,**  
Minnesota Agricultural Experiment Station, St. Paul.  
For primary bibliographic entry see Field 2K.  
W79-03653

**FACTORS AFFECTING ATRAZINE ADSORPTION, DEGRADATION AND MOBILITY IN SOIL,**  
Nebraska Univ., Lincoln. Dept. of Agronomy.  
For primary bibliographic entry see Field 5B.  
W79-03670

**SOME EFFECTS OF SOIL SURFACE COVER ON INFILTRATION,**  
Auburn Univ., AL.  
J. L. Koon.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 560. Price codes: A06 in paper copy, A01 in microfiche. Ph.D. Dissertation, August 1968, 86 p, 20 fig, 23 tab, 25 ref. OWRT A-005-ALA(2).

Descriptors: \*Soil surface cover, \*Infiltration rate, \*Raindrop impact, \*Regression analysis, \*Simulated rainfall, Soil types, Infiltration, \*Multiple regression techniques.

To evaluate the effects of soil surface cover on the infiltration rate of soils exposed to raindrop impact, simulated rainfall was applied at a constant rate to one soil type in small plots with free drainage, and aquare- and rectangular-cover particles of varying sizes and percentages were used as surface cover. The data were analyzed by multiple regression techniques and an expression relating the infiltration per unit length of cover perimeter to a characteristic geometrical distance was developed. The variables included in this analysis were: (1) the number of cover particles (N), (2) the perimeter of the individual cover particles (P), (3) the distance from the center of the cover particles to the center of space between cover particles (D), (4) the width of the cover particle (L), (5) the ratio of area covered (AC) to the total area (AT). The equation:  $100 / NP = 0.12 + 2.28 (2D - L) (AC/AT)$ , was shown to represent the data with a high coefficient of determination.  
W79-03676

**DERIVATION OF EQUATIONS FOR VARIABLE RAINFALL INFILTRATION,**  
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.

H. J. Morel Seytoux.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 573. Price codes: A03 in paper copy, A01 in microfiche. HYDROWAR Program, CEP76-77HJM47, Interim Report May 1977, 30 p, 7 fig, 9 ref, 2 append. OWRT B-144-COLO(4).

Descriptors: \*Infiltration, \*Infiltration rates, \*Variable rainfall, \*Equations, \*Ponding, Rainfall intensity, Soil moisture.

Formulae were derived for prediction of ponding time and cumulative infiltration following ponding under a condition of variable and even intermittent rainfall. The derivations do not assume immediate saturation at the surface nor a piston displacement of air by water; they include the viscous flow of air. The results were compared with experimental data for two conditions: constant rainfall and intermittent rainfall. The proposed formulae are simple to use, requiring no complex solution of a partial or

even an ordinary differential equation. The numerical calculations presented in the report were performed with a small pocket calculator. The agreement with experimental data is good.  
W79-03681

**EFFECT OF SOIL MOISTURE CONTENT UPON ADSORPTION AND MOVEMENT OF PHOSPHORUS FROM LEACHATES OF DOMESTIC WASTE DISPOSAL SYSTEMS,**  
Maine Univ. at Orono.  
For primary bibliographic entry see Field 5B.  
W79-03683

**COMPARATIVE GROWTH AND FOLIAR ELEMENT CONCENTRATIONS OF LARIX LARICINA OVER A RANGE OF WETLAND TYPES IN MINNESOTA,**  
Minnesota Univ., St. Paul. Dept. of Botany.  
For primary bibliographic entry see Field 21.  
W79-03739

**MICROBIAL POPULATIONS IN FLOODED SWAMP SOILS OF SOUTH CAROLINA,**  
Southeastern Forest Experiment Station, Asheville, NC.

D. S. Priester, and W. R. Harms.  
Research Note SE-238, Southeastern Forest Experiment Station, Asheville, North Carolina, April, 1977. 8 p, 2 fig, 4 tab, 8 ref.

Descriptors: \*Swamps, \*South Carolina, \*Soil microorganisms, Wetlands, Aquatic microorganisms, Soil bacteria, Actinomycetes, Clostridium, Soil microbiology, Soil fungi.

The effects were investigated of three kinds of flooding, soil type, and time of year on the growth of microorganisms in swamp soil of the Wehadkee and Portsmouth series. The soils flooded with moving water had significantly more aerobes and fewer anaerobes than did soils flooded with stagnant water. Soils that were deep-flooded with moving water had greater numbers of microbes than did the soils with stagnant water and those surface-flooded with moving water. The Wehadkee soil and significantly greater populations than did the portsmouth soil, regardless of water regime. Populations were greater in the summer than in the spring and fall. The most prevalent genus of aerobic and facultatively anaerobic bacteria was *Bacillus* Cohn, 1872. The actinomycetes isolated were *Nocardioides trevisanii*, 1889 and *Streptomyces* Waksman and Henrici, 1943. The only strict anaerobe was *Clostridium prazmowski*, 1880. Of the fungi, the most prevalent genera were *Penicillium* Link and *Cladosporium* Link. (Steiner-Mass) W79-03742

**AN INVESTIGATION OF THE BIOTIC FACTORS DETERMINING THE RATES OF PLANT DECOMPOSITION ON BLANKET BOG,**  
Durham Univ. (England). Dept. of Zoology.  
For primary bibliographic entry see Field 21.  
W79-03760

**EFFECTS OF SPARY IRRIGATION OF MUNICIPAL WASTEWATER ON THE PHYSICAL PROPERTIES OF THE SOIL,**  
Pennsylvania State Univ., University Park. School of Forest Resources.  
For primary bibliographic entry see Field 5C.  
W79-03766

**DISPLACEMENT OF SOIL WATER BY SIMULATED RAINFALL,**  
Kentucky Agricultural Experiment Station, Lexington.  
V. L. Quisenberry, and R. E. Phillips.  
Soil Science Society of America Journal, Vol 42, No 5, p 675-679, September-October 1978. 3 fig, 3 tab, 15 ref.

Descriptors: \*Soil moisture, \*Soil water movement, \*Simulated rainfall, \*Leaching, Soils. Rainfall, Hydrology, Soil water, Movement. On-site

## Field 2—WATER CYCLE

### Group 2G—Water In Soils

investigations, Moisture content, On-site tests, Laboratory tests, Percolation, \*Tritiated water tracer, Water movement in macropores, Soil-water displacement.

Displacement of initial soil water by simulated rainfall was measured in aggregates of Maury silt loam soil in columns in the laboratory and under field conditions using tritiated water and/or  $\text{Cl}^-$  as a tracer of added water. Displacement values measured in aggregates were larger (53 to 85%) than those measured under field conditions (7 to 56%). Percent displacement of initial soil water in Calloway silt loam under field conditions was similar to that of Maury, but was larger in Huntington silt loam than in Maury. Initial soil water content of Maury soil did not appear to affect percent displacement. Percent displacement in Maury soil increased as the depth of tillage increased. (Lee-ISWS)  
W79-03799

#### A MATHEMATICAL TREATMENT OF INFILTRATION FROM A LINE SOURCE INTO AN INCLINED POROUS MEDIUM,

Colorado State Univ., Fort Collins. Dept. of Mathematics.

D. W. Zachmann.  
Soil Science Society of America Journal, Vol 42, No. 5, p 685-688, September-October 1978. 3 fig, 1 tab, 15 ref.

Descriptors: \*Infiltration, \*Hydraulic conductivity, \*Porous media, \*Model studies, Mathematical models, Soil water, Soil water movement, Soils, Clays, Sands, Steady flow, Equations, Soil science, Line sources.

An exact mathematical solution was obtained for two-dimensional, steady infiltration from a line source into an inclined porous medium with an impermeable lower boundary. Unsaturated hydraulic conductivity was assumed to be an exponential function of pressure head. Equations for a stream function and the pressure head were developed, and stream lines and contours of constant pressure head were plotted for a sandy soil and a clay soil using inclinations of 5 deg and 20 deg from horizontal. (Sims-ISWS)  
W79-03800

#### CHEMICAL CHARACTERIZATION OF THE GASEOUS AND LIQUID ENVIRONMENTS OF SUBSURFACE DRAIN SYSTEMS,

Agricultural Research Service, Brawley, CA. Imperial Valley Conservation Research Center.

For primary bibliographic entry see Field 2K.

W79-03801

#### MAP UNIT COMPOSITION ASSESSMENT USING DRAINAGE CLASSES DEFINED BY LANDSAT DATA,

Soil Conservation Service, Lafayette, IN.

For primary bibliographic entry see Field 7B.

W79-03802

#### THE EFFECT OF STABILIZED, HYDROPHOBIC AGGREGATE LAYER PROPERTIES ON SOIL WATER REGIME AND SEEDLING EMERGENCE,

Hebrew Univ., Rehovot (Israel). Faculty of Agriculture.

E. Rawitz, and A. Hazan.  
Soil Science Society of America Journal, Vol. 42, No. 5, p 787-793, September-October 1978. 9 fig, 2 tab, 24 ref.

Descriptors: \*Mulching, \*Water conservation, \*Soil moisture, Soil properties, Soil texture, Irrigation, Seeds, Seedbed treatment, Erosion, Laboratory tests, Evaporation, Wetting, Drying, Aggregates, Soil aggregates, Soil science, \*Seedling emergence, Soil crusts.

Soil crusts affect both the profile water regime and the fate of crop seedlings. The former is affected via modification of infiltration, evaporation, and redistribution, while mechanical crust impedance

prevents or retards seedling emergence. Growers alleviate this problem by frequent, small irrigations, which are costly in water, equipment, and labor. This study was conducted to determine whether surface soil properties could be modified by layers of stabilized, hydrophobic aggregates so as to render these irrigations unnecessary. Unstable aggregates of a clay-loam soil were treated with 7% potassium silicate and 1% polyvinyl acetate based on dry-weight of soil and sprayed in water to wet the soil to 15% gravimetric water content. Layers of soil mixes with different aggregate-size distribution were placed in transparent columns and given a simulated rainfall; then the progress of infiltration, redistribution, and drying was followed. The most promising mix was used in large outdoor tanks as a mulch for carrots, using 1- and 4-cm mulch layers with 0, 25, and 100% cover of the soil surface. The soil was given one post-sowing sprinkler irrigation, and the soil moisture regime was monitored by microtensiometers and a two-probe gamma gauge. A 100% cover of 4-cm deep mulch of treated aggregates was the most effective for water conservation. It decreased water loss by 20% over a 14-day period. Seedling emergence was close to 90% under a 1-cm mulch and 50% under a 4-cm layer, both of which were superior to the unmulched control treatment. (Sims-ISWS)  
W79-03803

#### TRANSPORT OF A NONCOHESIVE SANDY MIXTURE IN RAINFALL AND RUNOFF EXPERIMENTS,

Commonwealth Scientific and Industrial Research Organization, Canberra (Australia).

For primary bibliographic entry see Field 2J.

W79-03804

#### THE BEHAVIOR OF NUTRIENT ELEMENTS ADDED TO A FOREST SOIL WITH SEWAGE SLUDGE,

Washington Univ., Seattle. Center of Ecosystem Studies.

For primary bibliographic entry see Field 5B.

W79-03805

#### GRAVIMETRIC VS. VOLUMETRIC DETERMINATION OF WATER STORAGE IN VERTICALLY UNSTABLE TILLAGE LAYERS,

Agricultural Research Organization, Bet Dagan (Israel). Inst. of Soils and Water.

For primary bibliographic entry see Field 7B.

W79-03806

#### COMPARISON OF CALCULATED AND EXPERIMENTALLY DETERMINED VALUES OF SOIL-WATER DIFFUSIVITY,

Haryana Agricultural Univ., Hissar (India). Dept. of Soils.

F. El-Komos, M. C. Oswal, and S. S. Khanna.  
Journal of Hydrology, Vol 39, No 1/2, p 105-111, October 1978. 3 fig, 1 tab, 10 ref.

Descriptors: \*Soil moisture, \*Diffusivity, \*Unsaturated flow, \*Soil water movement, Soil physics, Pore pressure, Drainage, On-site tests, Porous media, Laboratory tests, Unsteady flow, Conductivity, Experiments.

Soil water diffusivity values of a sandy loam soil, measured by Bruce and Klute's and Gardner's methods, were compared with those calculated from the moisture-suction relationship. The measured values of diffusivity were correlated significantly with calculated values of diffusivity. Bruce and Klute's method overestimated diffusivity values at different moisture contents compared with those calculated from the moisture-suction relationship. Diffusivity values measured by Gardner's method and those calculated were almost identical. (Adams-ISWS)  
W79-03812

#### NATIONAL CONFERENCE ON MANAGEMENT OF NITROGEN IN IRRIGATED AGRICULTURE.

For primary bibliographic entry see Field 5G.  
W79-03941

#### LEACHING OF NITRATE FROM SOILS,

Washington State Univ., Pullman. Dept. of Agronomy and Soils.

For primary bibliographic entry see Field 5G.

W79-03948

#### SOLUTE TRAVEL-TIME ESTIMATES FOR TILE-DRAINED FIELDS: III. REMOVAL OF A GEOTHERMAL BRINE SPILL FROM OIL BY LEACHING,

California Univ., Riverside. Dept. of Soil and Environmental Sciences.

W. A. Jury, and L. V. Weeks.

Soil Science Society of America Journal, Vol. 42, No. 5, p 679-684, September-October 1978. 7 fig, 3 tab, 10 ref.

Descriptors: \*Leaching, \*Salts, \*Ion exchange, \*Model studies, Mathematical models, Groundwater movement, Solutes, Saline water, Brines, Tile drains, Tile drainage, Soils, Soil water, Thermal water, Travel time.

The time required to leach a slug of saline, sodic geothermal brine from the point of injection to the tile outlet of an artificially drained field was calculated. Sprinkler, complete, and partial ponding leaching methods were compared as a function of drain spacing and initial location of the spill. Calculated results were presented as dimensionless parameters which scale the drainage system dimensions and the soil water transport properties. Ponded leaching required more water, but less time to leach brine out of the system for all situations except where the brine spill occurs near the midpoint between tile lines. A simple calculation was proposed to estimate the leaching fluid volume required to remove excess  $\text{Na}^+$  from the exchange complex. Good agreement was attained between simulated and experimental results involving a laboratory soil column. For fine-textured soils in the Imperial Valley of California, it may require up to 30 pore volumes of leaching fluid to replace  $\text{Na}^+$  with  $\text{Ca}^{2+}$  if saturated gypsum solution is used in reclamation. Application time per pore volume was calculated to be in excess of 1 year for all cases except ponded leaching directly over a tile line. (See also W76-05905 and W76-05904) (Sims-ISWS)  
W79-03961

#### COUPLING PHENOMENA IN SATURATED HOMO-IONIC MONTMORILLONITE: III. ANALYSIS,

Guelph Univ. (Ontario). Dept. of Land Resource Science.

P. H. Groenewelt, D. E. Elrick, and T. J. M. Blom.  
Soil Science Society of America Journal, Vol. 42, No. 5, p. 671-674, September-October 1978. 1 fig, 2 tab, 3 ref.

Descriptors: \*Montmorillonite, \*Ion transport, \*Equations, \*Mathematical models, Evaluation, Data processing, Electrodes, Sodium, Chlorides, Clays, Zeta potential, Electrochemistry, Cations, Clay-water-salt systems, Data analysis, Transport equations.

The data presented in the first paper of this series were analyzed using the theoretical transport equations and the analytical expressions for the transport equations and the analytical expression for the transport coefficients developed in the second paper of the series. When the electrodes of the system presented in Part I of this series are not shorted, the predicted behavior corresponds precisely with the actual behavior. Upon shorting the electrodes, the data indicated that the actual shorting of the clay-water system is not perfect, an indication that the electrodes cannot release and absorb  $\text{Cl}^-$  ions infinitely fast. From the data, the shorting efficiency was calculated. The flux of cations through the clay-water system while the electrodes are shorted can be calculated. The absolute value of this flux appears to be slightly larger than the value calculated from the decrease

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## WATER CYCLE—Field 2

### Lakes—Group 2H

in time of the salt concentration difference in the two liquid compartments. This is likely due to the buildup of a salt concentration gradient in the membranes. (See also W77-01138, W77-05420) (Vicksburg-ISWS)  
W79-03962

**INVESTIGATION OF LANDFILL LEACHATE POLLUTANT ATTENUATION BY SOILS,**  
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.  
For primary bibliographic entry see Field 5B.  
W79-03983

**FACTORS INFLUENCING THE VOLATILIZATION OF MERCURY FROM SOIL,**  
Environmental Monitoring and Support Lab., Las Vegas, NV.  
For primary bibliographic entry see Field 5B.  
W79-03988

### 2H. Lakes

**THE DECLINE OF LAKE PLANTS,**  
For primary bibliographic entry see Field 5C.  
W79-03508

**THE BLUE-GREEN ALGAE KEEP COMING,**  
For primary bibliographic entry see Field 5C.  
W79-03510

**SURVIVAL AND VIABILITY OF ESCHERICHIA COLI IN A THERMALLY ALTERED RESERVOIR,**  
Savannah River Lab., Aiken, SC.  
For primary bibliographic entry see Field 5C.  
W79-03556

**RETARDATION OF SEDIMENT PHOSPHORUS RELEASE BY FLY ASH APPLICATION,**  
Notre Dame Univ., IN.  
For primary bibliographic entry see Field 5C.  
W79-03560

**DEMONSTRATION OF INTERIM TECHNIQUES OF POLLUTED BEACHWATER,**  
Cleveland Dept. of Public Works, OH.  
For primary bibliographic entry see Field 5G.  
W79-03576

**SEMI-INFINITE SOLID MODEL FOR PREDICTION OF TEMPERATURE IN DEEP RESERVOIRS AND LAKES,**  
Arkansas Univ., Fayetteville. Dept. of Chemical Engineering.  
L. J. Thibodeaux.  
Water Resources Bulletin, Vol. 11, No. 3, p 449-454, June 1975. 2 fig, 1 tab, 5 ref. OWRT A-026-ARK(1).

Descriptors: \*Mathematical models, \*Lakes, \*Thermal properties, \*Thermocline, Isotherms, Water properties, Reservoirs, Energy equation, Equations, \*Arkansas.

A proposed thermal model to accompany a primary production model for the eutrophication processes in lakes is presented. A lake, visualized as a solid body occupying the space from  $X=D$  to  $X=\infty$ , is heated mainly through the air-water interface. Mathematical equations give the surface temperature, the temperature profile, including depth, and the position of the thermocline as a function of time. Preliminary tests of the interpretive and predictive aspects of the proposed model were carried out using temperature field data on Beaver Reservoir in Northwest Arkansas. In deep fresh water bodies, the general shape of the temperature profile is structured by the net heat input at the air-water interface and the time lapse since an isotherm state existed. (Davidson-IPA)  
W79-03581

**CADMUM AND ZINC IN MUSCLE OF BLUEGILL (LEPOMIS MACROCHIRUS) AND LARGEMOUTH BASS (MICROPTERUS SALMOIDES) FROM AN INDUSTRIALLY CONTAMINATED LAKE,**  
Purdue Univ., Lafayette, IN. Dept. of Bionucleonics.

For primary bibliographic entry see Field 5A.  
W79-03640

**THE LANDSAT LAKE EUTROPHICATION STUDY,**  
Wisconsin Univ.-Madison. Dept. of Civil and Environmental Engineering.

For primary bibliographic entry see Field 7B.  
W79-03682

**ECOLOGICAL DISTRIBUTION OF BREEDING WATERFOWL POPULATIONS IN NORTH DAKOTA,**  
Fish and Wildlife Service, Jamestown, ND. Northern Prairie Wildlife Research Center.

For primary bibliographic entry see Field 21.  
W79-03732

**SEASONAL CHANGES IN THE STANDING CROP OF TWO MONTANE SEDGES,**  
Minnesota Univ., Minneapolis. Dept. of Botany.  
For primary bibliographic entry see Field 21.  
W79-03734

**VEGETATION CHANGES IN SHALLOW MARSH WETLANDS UNDER IMPROVING MOISTURE REGIME,**  
Canadian Wildlife Service, Saskatoon (Saskatchewan).

For primary bibliographic entry see Field 21.  
W79-03735

**PRIMARY PRODUCTION AND LIFE HISTORY OF CAREX LACustris,**  
Ithaca Coll., NY. Dept. of Biology.  
For primary bibliographic entry see Field 21.  
W79-03737

**COMPARATIVE GROWTH AND FOLIAR ELEMENT CONCENTRATIONS OF LARIX LARicina OVER A RANGE OF WETLAND TYPES IN MINNESOTA,**  
Minnesota Univ., St. Paul. Dept. of Botany.  
For primary bibliographic entry see Field 21.  
W79-03739

**AN ANALYSIS OF LAKE LEVEL INFLUENCE ON VEGETATION IN LAKE CHAMPLAIN,**  
Aquatec, Inc., South Burlington, VT.  
W. D. Countryman.

Fish and Wildlife Service, Newton Corner, Massachusetts, August, 1977. 2 fig, 117 ref, 4 append.

Descriptors: \*Wetlands, \*Lake Champlain, \*Water levels, \*Vegetation effects, Marshes, Freshwater marshes, Marsh management, Reservoir management, Lakes.

If water levels were controlled so as not to exceed 30.5 meters, only minor changes in existing wetland plant communities would occur. The major plant association to be affected by such a regulation scheme would be the grass and sedge meadow community. Historically, the areas occupied by this plant association are only inundated for short periods of time in the spring and only in years of high water. If water levels were controlled so as not to exceed 30.0 meters, a slight loss of swamp forest community would occur in addition to the loss of the grass and sedge meadow. Regulation so as not to exceed 29.5 meters would result in the loss of much of the swamp forest and slight changes in the emergent plant community. If water levels were regulated so as not to exceed 29.0 meters, major changes to all marsh land vegetation communities would occur. (Steiner-Mass)  
W79-03745

**PHENOLOGY, DISTRIBUTION, AND SURVIVAL OF ATRIPLEX TRIANGULARIS WILLD. IN AN OHIO SALT PAN,**  
Ohio Univ., Athens. Dept. of Botany.

For primary bibliographic entry see Field 21.  
W79-03749

**NUTRIENT AND WATER LEVELS IN A SMALL MICHIGAN BOG WITH HIGH TREE MORTALITY,**  
Michigan Univ., Pellston. Biological Station.

For primary bibliographic entry see Field 21.  
W79-03751

**MINERAL CONCENTRATIONS IN PAPYRUS IN VARIOUS AFRICAN SWAMPS,**  
Nairobi Univ. (Kenya). Dept. of Botany.

For primary bibliographic entry see Field 21.  
W79-03753

**PRIMARY PRODUCTION IN THE FRESHWATER MARSH ECOSYSTEM OF TROY MEADOWS, NEW JERSEY,**  
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Botany.

R. A. Jervis.  
Bulletin of the Torrey Botanical Club, Vol. 96, No. 2, p 209-231, 1969. 7 fig, 5 tab, 59 ref.

Descriptors: \*Freshwater marshes, \*New Jersey, \*Primary productivity, Wetlands, Marshes, Marsh plants, Productivity, Cattails, Rooted aquatic plants, Efficiencies.

Primary production was studied in four freshwater marsh communities: an open aquatic system of emergent and floating plants, a cattail community, a swale of sedge tussocks and associated herbaceous tussock colonists, and a sedge-shrub thicket. Although the four communities differed considerably in vegetative structure, they did not differ significantly in production rates or production efficiencies (production per unit of leaf surface). The seasonal course of production varied among species and among communities. In general, early summer was the most productive period. It followed a springtime development of photosynthetic capital, which was most rapid in the predominantly rhizomatous cattail community when there was a marked recall of stored foods. Production thereafter decreased except for a slight fall upswing. The estimated average (9.50 g/sq m/day) and maximum (20.94 g/sq m/day during the early summer) productivities are among the highest reported for natural vegetation. Soil colloids and the ground water nutrient level were high, and it is suggested that these variables, along with the abundance of soil moisture and an unusually well-adapted flora, are the major factors contributing to the high marsh productivity. (Steiner-Mass)  
W79-03758

**PRODUCTION, NUTRIENT CONTENT AND DECOMPOSITION OF PHRAGMITES COMMUNIS TRIN. AND TYPA ANGUSTIFOLIA L.,**  
University of East Anglia, Norwich (England). School of Biological Sciences.

For primary bibliographic entry see Field 21.  
W79-03759

**AN INVESTIGATION OF THE BIOTIC FACTORS DETERMINING THE RATES OF PLANT DECOMPOSITION ON BLANKET BOG,**  
Durham Univ. (England). Dept. of Zoology.  
For primary bibliographic entry see Field 21.  
W79-03760

**CULTURAL EUTROPHICATION OF LONG LAKE, WASHINGTON,**  
Eastern Washington State Coll., Cheney. Dept. of Biology.  
For primary bibliographic entry see Field 5C.  
W79-03777

## Field 2—WATER CYCLE

### Group 2H—Lakes

**SCENARIO FOR AN ONGOING CHLOROPHYLL A SURVEILLANCE PLAN ON LAKE ONTARIO FOR NON-INTENSIVE SAMPLING YEARS,**

Canada Centre for Inland Waters, Burlington (Ontario).

For primary bibliographic entry see Field 5A.  
W79-03808

**POTENTIAL SOURCES OF ASBESTOS IN LAKE MICHIGAN,**

Illinois Univ. at the Medical Center, Chicago. School of Public Health.

For primary bibliographic entry see Field 5B.  
W79-03809

**MIREX IN THE SEDIMENTS OF LAKE ONTARIO,**

Ontario Ministry of Agriculture and Food, Guelph. Pesticide Residue Lab.

For primary bibliographic entry see Field 5B.  
W79-03810

**THEORETICAL MODEL OF THE LITTORAL DRIFT SYSTEM IN THE TORONTO WATERFRONT AREA, LAKE ONTARIO,**

Scarborough Coll., Toronto (Ontario).

B. Greenwood, and D. G. McGillivray. Journal of Great Lakes Research, Vol. 4, No. 1, p 84-102, March 1978. 14 fig, 3 tab, 72 ref.

Descriptors: \*Littoral drift, \*Lake Ontario, \*Model studies, Mathematical models, Waves(Water), Lakes, Shores, Beaches, Geomorphology, Erosion, Deposition(Sediments), Sediment transport, Winds, Climatology, Theoretical analysis.

A computer model was described which simulated the interaction between shoreline geometry and shoaling waves in the Toronto waterfront area on the north shore of Lake Ontario, between Highland Creek in the east and the Credit River in the west, and established potential littoral drift patterns. Thirteen wave conditions, defined by height, period and direction of approach, characterizing the annual hindcast spectrum for Toronto, were used in the determination of the shore-parallel components of wave energy flux. To identify the long-term net effects of the distribution of wave energy flux which produce the dominant littoral drift pattern, a simple summation procedure was used whereby the individual effect of any wave condition at a shoreline point is weighted according to its frequency of occurrence. The long-term average pattern of potential littoral drift, based on zones of potential erosion (increasing alongshore wave energy flux), transport (constant alongshore wave energy flux), and deposition (decreasing alongshore wave energy flux), was established. Identification of nodal points (zero alongshore wave energy flux) and drift cells allows a test of the 'geomorphological sense' of the model by comparison with observed drift patterns. (Sims-ISWS) W79-03811

**CARBON FLOW IN FOUR LAKE ECOSYSTEMS: A STRUCTURAL APPROACH,** Washington Univ., Seattle. Fisheries Research Inst.

For primary bibliographic entry see Field 5C.  
W79-03815

**SYMPORIUM: EXPERIMENTAL USE OF ALGAL CULTURES IN LIMNOLOGY; SANDEFJORD, NORWAY, 26-28 OCTOBER 1976.** Internationale Vereinigung fuer Theoretische und Angewandte Limnologie, Stuttgart (Germany, F.R.).

For primary bibliographic entry see Field 5C.  
W79-03842

**ANATOXINS FROM CLONES OF ANABAENA FLOS-AQUAE ISOLATED FROM LAKES OF WESTERN CANADA,** Alberta Univ., Edmonton. Dept. of Botany.

For primary bibliographic entry see Field 5C.  
W79-03870

**THE USE OF NATURAL PHYTOPLANKTON POPULATIONS IN BIOASSAY,**

California Univ., Davis. Div. of Environmental Studies.

For primary bibliographic entry see Field 5A.  
W79-03876

**USE OF LABORATORY CULTURES OF SELENASTRUM, ANABAENA AND THE INDIGENOUS ISOLATE SPAEROCYSTIS TO PREDICT EFFECTS OF NUTRIENT AND ZINC INTERACTIONS UPON PHYTOPLANKTON GROWTH IN LONG LAKE, WASHINGTON,**

Corvallis Environmental Research Lab., OR.

For primary bibliographic entry see Field 5C.  
W79-03877

**THE APPLICATION OF CULTURE METHODS IN STUDIES OF THE ECOLOGY OF SMALL GREEN ALGAE,**

University Coll. of North Wales, Bangor. School of Plant Biology.

For primary bibliographic entry see Field 5A.  
W79-03878

**THE USE OF SMALL, CONTINUOUS AND MULTISPECIES CULTURES TO INVESTIGATE THE ECOLOGY OF PHYTOPLANKTON IN A SCOTTISH SEA-LOCH,**

University of Strathclyde, Glasgow (Scotland). Dept. of Applied Microbiology.

For primary bibliographic entry see Field 5C.  
W79-03879

**THE ALGAL GROWTH POTENTIAL OF AN INLAND SALINE AND EUTROPHIC LAKE,** North Dakota Univ., Grand Forks. Dept. of Biology.

For primary bibliographic entry see Field 5C.  
W79-03891

**COHO SALMON (ONCORHYNCHUS KISUTCH) AND HERRING GULLS (LARUS ARGENTATUS) AS INDICATORS OF ORGANIC CHLORINE CONTAMINATION IN LAKE ONTARIO,**

Canadian Wildlife Service, Ottawa (Ontario). Wildlife Toxicology Div.

For primary bibliographic entry see Field 5A.  
W79-03895

**CORRELATIONS BETWEEN SPECIFIC ALGAE AND HEAVY METAL BINDING IN LAKES,**

Ottawa Univ. (Ontario). Dept. of Biology. For primary bibliographic entry see Field 5C.  
W79-03896

**DYNAMICS OF AN ICE COVERED LAKE WITH THROUGH-FLOW,**

Goteborg Univ. (Sweden). Dept. of Oceanography.

A. Stigebrandt. Nordic Hydrology, Vol. 9, No 3/4, p 219-244, 1978. 10 fig, 3 tab, 15 ref, 5 append.

Descriptors: \*Lakes, \*Ice cover, \*Dynamics, Flow, Temperature, Water temperature, Circulation, Mixing, Heat transfer, Discharge(Water), Withdrawal, Theoretical analysis, Model studies, On-site investigations, Limnology, Water circulation, \*Sweden.

The dynamics of different regimes in an ice covered inland lake with through-flow were discussed. A new theory for selective withdrawal was tested with success. The mixing of the entering river with lake water was estimated, and it was found that the net volume flux increases about 60% through the mixing. The flow in the main part of the lake was

discussed, and some measurements were presented. (Sims-ISWS)  
W79-03898

**BALANCE OF ORGANIC MATTER IN THE ECOSYSTEM OF THE RYBINSKIY RESERVOIR,**

Akademika Nauk SSSR, Moscow. Inst. Biologii Vnutrennykh Vod.

For primary bibliographic entry see Field 5C.  
W79-03918

**HISTORY OF CHANGES IN FISH SPECIES OF THE GREAT LAKES,**

For primary bibliographic entry see Field 5C.  
W79-03924

**SEA LAMPREY (PETROMYZON MARINUS LINNAEUS) IN THE SAINT LAWRENCE GREAT LAKES OF NORTH AMERICA: EFFECTS, CONTROL, RESULTS,**

For primary bibliographic entry see Field 5C.  
W79-03925

**GEOLOGIC POLLUTION PROBLEMS OF LAKE SUPERIOR,**

For primary bibliographic entry see Field 5B.  
W79-03938

**DISTRIBUTION OF PHYTOPLANKTON IN ILLINOIS LAKES,**

Nevada Univ., Las Vegas. Dept. of Biological Sciences.

For primary bibliographic entry see Field 5C.  
W79-03989

**DISTRIBUTION OF PHYTOPLANKTON IN NORTH CAROLINA LAKES,**

Nevada Univ., Las Vegas. Dept. of Biological Sciences.

For primary bibliographic entry see Field 5C.  
W79-03990

**DISTRIBUTION OF PHYTOPLANKTON IN INDIANA LAKES,**

Nevada Univ., Las Vegas. Dept. of Biological Sciences.

For primary bibliographic entry see Field 5C.  
W79-03991

**POLYCHLORINATED BIPHENYLS IN PRECIPITATION IN THE LAKE MICHIGAN BASIN,**

DePaul Univ., Chicago, IL.

For primary bibliographic entry see Field 5C.  
W79-03993

**SIZE DEPENDENT MODEL OF HAZARDOUS SUBSTANCES IN AQUATIC FOOD CHAIN,**

Manhattan Coll., Bronx, NY.

For primary bibliographic entry see Field 5C.  
W79-03997

### 21. Water In Plants

**QUANTITATIVE ESTIMATION OF LIVING WHEAT-ROOT LENGTHS IN SOIL CORES,**

Agricultural Research Service, Pendleton, OR. Columbia Plateau Conservation Research Center.

For primary bibliographic entry see Field 3F.  
W79-03514

**EFFECTS OF SOIL WATER STRESS ON GROWTH AND NUTRIENT ACCUMULATION IN CORN,**

Kasetsart Univ., Bangkok (Thailand). Dept. of Soil Science.

For primary bibliographic entry see Field 3F.  
W79-03553

## WATER CYCLE—Field 2

### Water In Plants—Group 21

#### THE EFFECT OF COMPETITION AND SALINITY ON THE GROWTH OF A SALT MARSH PLANT SPECIES

California Univ., Davis. Dept. of Botany.

M. G. Barbour.

Oecologia, Vol. 37, p 93-99, 1978. 1 fig, 3 tab, 12 ref.

Descriptors: \*Plant growth, \*Salinity, \*Salt marshes, \*Competition, Rhizomes, Salt tolerance, Perennial ryegrass, Habitats, Plant growth regulators, Plant physiology, Ecology, Halophytes, \*Juncus.

Young rhizome sprouts of the herbaceous perennial *Juncus carnosus* were propagated from material collected in a salt marsh along the central California coast. The sprouts were transplanted to flats of sand sown with different densities of seeds of a representative glycophyte, *Lolium perenne*. In the monospecific control flats, the growth of both species declined with increasing salinity, but the relative decline of *Lolium* was three times that of *Juncus*. Both species grew well when subirrigated by 400 ppm salt water, but grew poorly when subirrigated by 11,600 ppm salt water, indicating that aeration alone is not the most significant factor in the marsh. The effect of interspecific competition on *Juncus* was marked at low salinity, depressing growth by 52% compared to controls, but at high salinity the competitive effect was insignificant, whether the plants were watered from above or subirrigated. This supports the hypothesis that intolerant halophytes such as *Juncus* are restricted in nature to salt marshes because they are poor competitors with glycophytes on non-saline soils. (EIS-Deal)

W79-03634

#### CLASSIFICATION OF RIPARIAN HABITAT IN THE SOUTHWEST

Rocky Mountain Forest and Range Experiment Station, Tempe, AZ.

C. P. Pase, and E. F. Layser.

In: Importance, Preservation and Management of Riparian Habitat: A Symposium, July 9, 1977, Tucson, Arizona, USDA Forest Service General Technical Report RM-43 p. 5-9. 8 fig, 13 ref.

Descriptors: \*Riparian plants, \*Vegetation, Southwest U.S., \*Classification, Arizona, New Mexico, Trees, Streams, Wetlands, Habitats.

A tentative classification system based on the work of Brown and Lowe is proposed as a working model. Six biomes, nine series, and 23 associations are recognized. (Stihler-Mass)

W79-03704

#### IMPORTANCE OF RIPARIAN ECOSYSTEMS: BIOTIC CONSIDERATIONS

New Mexico Dept. of Game and Fish, Santa Fe.

J. P. Hubbard.

In: Importance, Preservation and Management of Riparian Habitat: A Symposium, July 9, 1977, Tucson, Arizona, USDA Forest Service General Technical Report RM-43, p. 14-18. 1 tab, 18 ref.

Descriptors: \*Riparian land, \*Wildlife, \*Habitats, Fish, Birds, Amphibians, Mammals, Southwest U.S., Wetlands, Ecosystems.

Riparian Ecosystems are of importance in maintaining the large degree of biotic diversity of the southwestern United States. Such habitats are of paramount importance in the survival of native fishes. Amphibians are seasonally dependent on riparian habitats. A number of bird species are dependent on riparian ecosystems; some mammal species also show this dependence. (Stihler-Mass)

W79-03706

#### VEGETATION STRUCTURE AND BIRD USE IN THE LOWER COLORADO RIVER VALLEY

Arizona State Univ., Tempe. Dept. of Zoology;

and Arizona State Univ., Tempe. Center for Environmental Studies.

B. W. Anderson, and R. D. Ohmart.

In: Importance, Preservation and Management of

Riparian Habitat: A Symposium, July 9, 1977, Tucson, Arizona, USDA Forest Service General Technical Report RM-43, p. 23-34. 1 fig, 6 tab, 27 ref.

Descriptors: \*Riparian land, \*Birds, \*Habitats, Structure, Seasonal, Habitat breadths, \*Colorado River Valley.

Correlations between bird population parameters and vegetation structure characteristics were found to vary seasonally. Mean habitat breadth of all species is narrowest with respect to vegetative structure in winter and broadest in summer; permanent residents occupy the structural types more evenly than visitors. Habitat breadth of various species is greater in summer than in winter. Narrow habitat breadths are accompanied by reduced habitat overlap among the species in winter, suggesting that winter is potentially the time of greatest stress. Permanent residents tend to be less specialized with respect to structure than visitors. (Stihler-Mass)

W79-03708

#### A RIPARIAN CASE HISTORY: THE COLORADO RIVER

Arizona State Univ., Tempe. Dept. of Zoology; and Arizona State Univ., Tempe. Center for Environmental Studies.

For primary bibliographic entry see Field 6G. W79-03709

#### ENDANGERED SPECIES VS. ENDANGERED HABITATS: A CONCEPT

Grand Canyon National Park, AZ.

For primary bibliographic entry see Field 6G. W79-03713

#### RIPARIAN RESEARCH NEEDS

Rocky Mountain Forest and Range Experiment Station, Tempe, AZ.

For primary bibliographic entry see Field 6G. W79-03714

#### CLASSIFICATION OF RIPARIAN VEGETATION

New Mexico State Univ., University Park. Dept. of Biology.

W. A. Dick-Peddie, and J. P. Hubbard.

In: Importance, Preservation and Management of Riparian Habitat: A Symposium, July 9, 1977, Tucson, Arizona, USDA Forest Service General Technical Report RM-43, p. 85-90. 13 ref.

Descriptors: \*Riparian plants, \*Riparian land, \*Classification, \*New Mexico, Southwest U.S., Trees, Vegetation, Rooted aquatic plants, Wetlands, Streams.

A classification system for riparian vegetation in New Mexico is presented. It is based upon obligate riparian species and the major topographic features which dictate their presence. (Stihler-Mass)

W79-03715

#### AN OVERVIEW OF RIPARIAN FORESTS IN CALIFORNIA: THEIR ECOLOGY AND CONSERVATION

California Univ., Davis. Inst. of Ecology.

A. Sands, and G. Howe.

In: Importance, Preservation and Management of Riparian Habitat: A Symposium, July 9, 1977, Tucson, Arizona, USDA Forest Service General Technical Report RM-43, p. 98-115. 1 tab, 60 ref.

Descriptors: \*Riparian land, \*California, \*Forests, Riparian plants, Trees, Vegetation, Rooted aquatic plants, Wetlands, Flood plains, Birds, Fish, Flood control, Erosion, Streams, Rivers, Geology, Sacramento River(Calif), Army Corps of Engineers.

This paper is comprised of abstracts from presentations made at the Symposium on Riparian Forests in California: Their Ecology and Conservation held in Davis, California on May 14, 1977. Presentation titles are: A short review of the status of

riparian forests in California, Geological history of the riparian forests of California, Riparian forests of the Sacramento Valley, California, The fluvial system: Selected observations, Riparian vegetation and flora of the Sacramento Valley, The valley riparian forests of California and their importance to bird populations, Habitats of native fishes in the Sacramento River Basin, and Environmental Applications in Corps of Engineers work with reference to riparian vegetation management. (Stihler-Mass)

W79-03716

#### REGENERATION AND DISTRIBUTION OF Sycamore and Cottonwood Trees Along Sonora Creek, Santa Cruz County, Arizona

Arizona State Univ., Tempe. Dept. of Zoology.

R. L. Glinski.

In: Importance, Preservation and Management of Riparian Habitat: A Symposium, July 9, 1977, Tucson, Arizona, USDA Forest Service General Technical Report RM-43, p. 116-123. 2 fig, 1 tab, 9 ref.

Descriptors: \*Riparian plants, \*Riparian land, \*Trees, \*Sycamore trees, \*Cottonwoods, Arizona, Streams, Grazing, Habitats, Erosion, Wetlands, Southwest U.S., Reproduction.

Sycamores reproduced from root and trunk sprouts and because of this their distribution is not as likely to change significantly. Cottonwood reproduction was nearly absent in areas grazed by cattle, and was confined to the narrow erosion channel. If this regeneration pattern continues, the future maximum width of the cottonwood forest will decrease nearly 60%. (Stihler-Mass)

W79-03717

#### INFLUENCES OF RIPARIAN VEGETATION ON AQUATIC ECOSYSTEMS WITH PARTICULAR REFERENCE TO SALMONID FISHES AND THEIR FOOD SUPPLY

Pacific Northwest Forest and Range Experiment Station, Corvallis, OR. Forestry Sciences Lab.

W. R. Meehan, F. J. Swanson, and J. R. Sedell.

In: Importance, Preservation and Management of Riparian Habitat: A Symposium, July 9, 1977, Tucson, Arizona, USDA Forest Service General Technical Report RM-43, p. 137-145. 4 fig, 26 ref.

Descriptors: \*Riparian land, \*Salmonids, \*Habitats, \*Effects, \*Riparian plants, Streams, Wetlands, Time, Temperature, Sediments, Vegetation, Grazing, Insects, Fish, Southwest U.S.

The riparian zone has important influences on the total stream ecosystem including the habitat of salmonids. Shade and organic detritus from the riparian zone control the food base of the stream and large woody debris influences channel morphology. The effectiveness of a riparian zone in regulating input of light, dissolved nutrients and litterfall to the stream varies through time following wildfire, clearcutting or other disturbances. The influence and role of riparian vegetation will vary with stream order and position along the continuum from headwaters to mouth. Riparian zones are affected by livestock grazing, logging, and road construction. (Stihler-Mass)

W79-03720

#### ECOLOGICAL STUDY OF SOUTHWESTERN RIPARIAN HABITATS: TECHNIQUES AND DATA AVAILABILITY

Arizona State Univ., Tempe. Dept. of Zoology; and Arizona State Univ., Tempe. Center for Environmental Studies.

For primary bibliographic entry see Field 6G.

W79-03721

#### THE IMPORTANCE OF RIPARIAN HABITAT TO MIGRATING BIRDS

Museum of Northern Arizona, Inc., Flagstaff.

L. E. Stevens, B. T. Brown, J. M. Simpson, and R. R. Johnson.

In: Importance, Preservation and Management of

## Field 2—WATER CYCLE

### Group 2I—Water In Plants

Riparian Habitat: A Symposium, July 9, 1977, Tucson, Arizona, USDA Forest Service General Technical Report RM-43, p. 156-164. 2 fig, 4 tab, 24 ref.

Descriptors: \*Migratory birds, \*Riparian land, \*Southwest U.S., \*Ecological distribution, Ecology, Birds, Wildlife, \*Riparian plants, Vegetation, Habitats, Wetlands, Streams, Rivers.

Seven pairs of study sites in riparian and adjacent, nonriparian habitats were censused for spring migrant passerines. Riparian plots contained up to 10.6 times the number of migrants per hectare found on adjacent, nonriparian plots. Stop-over habitat selection is indicated by differing migrant densities and species diversities in various habitats. Insectivorous migrants generally preferred riparian habitats. Granivores displayed habitat selection by avoiding dense riparian forests and woodland situations and concentrated in adjacent shrublands and open riparian forests. (Stihler-Mass) W79-03722

#### SIGNIFICANCE OF RIO GRANDE RIPARIAN SYSTEMS UPON THE AVIFAUNA,

National Park Service, Santa Fe, NM. Southwest Region.

R. H. Wauer.

In: Importance, Preservation and Management of Riparian Habitat: A Symposium, July 9, 1977, Tucson, Arizona, USDA Forest Service General Technical Report RM-43, p. 165-174. 1 tab, 24 ref.

Descriptors: \*Rio Grande River, \*Riparian land, \*Birds, Habitats, Riparian plants, Vegetation, Wildlife, Wetlands, Rivers, \*Texas, Migratory birds, Southwest U.S.

The Rio Grande corridor in West Texas serves as a significant migratory and emigration route for avifauna, and 38 species are known to meet within the riparian habitat. A total of 94 species are known to breed within riparian systems within the American Southwest. The Rio Grande area provides suitable habitat for 40% of those. Nine species—great blue and green herons, peregrine falcon, American kestrel, white-winged dove, screech owl, Bell's vireo, yellow warbler, and bronzed cowbird—are discussed as indicators of changes within the system and the importance of the Rio Grande area as a refugium. (Stihler-Mass) W79-03723

#### POPULATION FLUCTUATIONS IN NOCTURNAL RODENTS IN THE LOWER COLORADO RIVER VALLEY,

Arizona State Univ., Tempe. Dept. of Zoology, and Arizona State Univ., Tempe. Center for Environmental Studies.

B. W. Anderson, J. Drake, and R. D. Ohmart.

In: Importance, Preservation and Management of Riparian Habitat: A Symposium, July 9, 1977, Tucson, Arizona, USDA Forest Service General Technical Report RM-43, p. 183-192. 9 fig, 2 tab, 8 ref.

Descriptors: \*Colorado River, \*Mammals, \*Rodents, \*Cycles, Seasonal, Riparian land, Vegetation, Willow trees, Mesquite, Rivers, Wetlands, Southwest U.S., Wildlife.

An examination of population fluctuations in a sample of over 10,000 rodents comprising five species collected along the lower Colorado River revealed distinct seasonal (annual) cycles in *Perognathus penicillatus* and *Dipodomys merriami*. Overall rodent populations were decreasing for the 3.5 year period for which data are presented. This was most pronounced in *Peromyscus eremicus*. Although these populations were declining, there was significant intraspecific asynchrony among the populations in different vegetation types. There was also a significant degree of interspecific asynchrony in population fluctuations which renders the task of evaluating habitat difficult and subject to error unless carried out for several years in various vegetation types. (Stihler-Mass) W79-03725

#### CLIMATOLOGICAL AND PHYSICAL CHARACTERISTICS AFFECTING AVIAN POPULATION ESTIMATES IN SOUTHWESTERN RIPARIAN COMMUNITIES USING TRANSECT COUNTS,

Arizona State Univ., Tempe. Dept. of Zoology, and Arizona State Univ., Tempe. Center for Environmental Studies.

For primary bibliographic entry see Field 2B. W79-03726

#### SOUTHWESTERN RIPARIAN COMMUNITIES: THEIR BIOTIC IMPORTANCE AND MANAGEMENT IN ARIZONA,

Arizona Game and Fish Dept., Phoenix.

For primary bibliographic entry see Field 6G. W79-03727

#### TERRESTRIAL MAMMALS OF THE RIPARIAN CORRIDOR IN BIG BEND NATIONAL PARK,

Texas A and M Univ., College Station Dept. of Wildlife and Fisheries Sciences.

W. J. Bocer, and D. J. Schmidt.

In: Importance, Preservation & Management of Riparian Habitat: A Symposium, July 9, 1977, Tucson, Arizona USDA Forest Service General Technical Report RM-43, p. 212-217. 2 tab, 15 ref.

Descriptors: \*Riparian land, \*Mammals, \*Southwest U.S., \*Rodents, \*Rio Grande River, Wildlife, Vegetation, Trees, Cottonwoods, Willow trees, Habitats, Wetlands, Streams, Rivers, Grazing, Livestock, \*Big Bend National Park, Saltcedar, \*Texas.

Thirty species of terrestrial mammals inhabit riparian habitats in Big Bend National Park (BBNP) but only one species (the beaver, *Castor canadensis*) is restricted to those areas. Major changes in vegetation during the past 30 years, involving an increase in basal and canopy cover, have resulted in the elimination of at least one species (Ord's kangaroo rat, *Dipodomys ordii*) from the river corridor as well as increased abundance and distribution of two other species (*Hispida* cotton rat, *Sigmodon hispidus* and white-footed mouse, *Peromyscus leucopus*). Compared to other major plant communities in BBNP, the rodent fauna of the riparian community has lower evenness, richness, and diversity indices. Human use and trespass livestock grazing are the major impact acting upon the natural riparian communities in BBNP today. (Stihler-Mass) W79-03728

#### IMPORTANCE, PRESERVATION, AND MANAGEMENT OF RIPARIAN HABITAT: AN OVERVIEW,

Museum of Northern Arizona, Inc., Flagstaff. Dept. of Biology.

For primary bibliographic entry see Field 6G. W79-03729

#### SPECIALIZED HABITAT REQUIREMENTS OF BIRDS: SNAG MANAGEMENT, OLD GROWTH, AND RIPARIAN HABITAT,

Pacific Northwest Forest and Range Experiment Station, La Grande, OR.

E. L. Bull.

In: Workshop on Nongame Bird Habitat Management in Coniferous Forests of the Western United States, Portland, Oregon, February 7-9, 1977, p 74-82. 2 fig, 6 tab, 25 ref.

Descriptors: \*Wildlife habitat, Non-game birds, \*Riparian land, Habitats, Birds, Wildlife, Songbirds, Wildlife management, Wetlands, Forests.

The values, roles, and management of snags, old-growth forests, and riparian zones, are discussed as they relate to birds in forest ecosystems. Riparian habitat is an extremely critical and unique type. Riparian makes up the smallest percentage in land area of the habitat types, yet it is the most important habitat to wildlife whether it is in the Coast Ranges or on the desert. A diversity of birdlife is possible because of the diversity of habitat compo-

nents with riparian zones. This diversity enhances the richness and stability of the ecosystem over time and space. (Steiner-Mass) W79-03731

#### ECOLOGICAL DISTRIBUTION OF BREEDING WATERFOWL POPULATIONS IN NORTH DAKOTA,

Fish and Wildlife Service, Jamestown, ND. Northern Prairie Wildlife Research Center.

R. E. Stewart, and H. A. Kantrud.

Journal of Wildlife Management, Vol. 37, No. 1, p 39-50, January, 1973. 2 fig, 6 tab, 12 ref.

Descriptors: \*Grasslands, \*Potholes, \*Wetlands, \*Ecological distribution, \*Waterfowl, Wildlife, Freshwater marshes, Ecology, Water levels, Ponds, Marshes, \*North Dakota, Habitats, Animal populations.

The total wetland acreage in North Dakota was estimated as about 3.2 million acres. Natural basin wetland varied from a low of about 4% of total wetland acreage in the Southwestern Slope Region to a high of 93% in the Prairie Pothole Region, where about 84% of the statewide duck population occurred. Within the Prairie Pothole Region seasonal (Class III) ponds comprised 36 and 23%, respectively, of the total acreage and number of wetlands, and semipermanent (Class IV) ponds and lakes comprised 18 and 3%, respectively, of these totals. Agriculture has had drastic effects on wetlands in this region. In the Prairie Pothole Region, seasonal ponds and semipermanent ponds and lakes were utilized by about 48 and 27%, respectively, of the total breeding ducks. Optimum environmental conditions for breeding dabbling ducks were present during years when large numbers and acreages of seasonal (Class III) pond basins contained surface water. Semipermanent (Class IV) ponds and lakes were the principal habitats for breeding diving ducks, and were also important to dabbling ducks, particularly during dry years. (Howard-Mass) W79-03732

#### THE LIFE HISTORY OF SHOOTS OF CAREX LACUSTRIS,

Ithaca Coll., NY. Dept. of Biology.

J. M. Bernard.

Canadian Journal of Botany, Vol. 53, No. 3, p. 256-260, February 1, 1975. 5 fig, 1 tab, 10 ref.

Descriptors: \*Freshwater marshes, \*Rooted aquatic plants, \*Life history studies, Wetlands, Marshes, Plant growth, Period of growth, \*Sedges, \*New York.

Most shoots of *Carex lacustris* live for about 12 to 14 months, emerging in autumn overwintering as shoots of up to 50 cm in length, and maturing during the next summer. Others emerge in early spring but both groups die in late autumn. A third class emerges in late July or August, grow to be over 50 cm in length, and die in late autumn living only 2 or 3 months. Flower initials in this species begin growth in the September to October period and overwinter while about 1.0 cm in length. The shoots that develop inflorescences are in general longer, heavier, and have a greater basal diameter than those shoots which do not flower. More shoots flower if the water level in the marsh was high the previous year. (Howard-Mass) W79-03733

#### SEASONAL CHANGES IN THE STANDING CROP OF TWO MONTANE SEDGES,

Minnesota Univ., Minneapolis. Dept. of Botany. E. Gorham, and M. G. Somers.

Canadian Journal of Botany, Vol. 51, No. 6, p 1097-1108, June, 1973. 13 fig, 1 tab, 8 ref.

Descriptors: \*Wetlands, \*Standing crops, \*Rooted aquatic plants, \*Productivity, \*Rocky Mountain Region, Canada, Biomass, Ecology, \*Seasonal. Life history studies, Sedges.

Aboveground green biomass of a montane pure stand of *Carex rostrata* varies from about 125 g/sq

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## Water in Plants—Group 21

in (air-dry weight) at the end of November to about 640 g/sq m in early August. The maximum production rate of about 6 g/sq m per day occurs in May. For a nearby stand of *Carex aquatilis* with a prominent moss layer the aboveground green biomass of sedge material varies from about 40 g/sq m in February to about 380 g/sq m in mid-August. The maximum production rate for sedge material is about 4 g/sq m per day in July. Both species exhibit two main populations of shoots, one emerging in late summer and the other through winter and early spring. The winter and spring shoots of *Carex rostrata* flower and die after about 18 months, while the late summer shoots, which do not mature vegetatively until the following summer, have a life-span of about 2 years. The late summer shoots of *Carex aquatilis* mature vegetatively before winter, and flower and die within about 12 months; while the winter and spring shoots live through the next winter, and flower and die the following summer after a life-span of about 18 months. (Howard-Mass)  
W79-03734

**VEGETATION CHANGES IN SHALLOW MARSH WETLANDS UNDER IMPROVING MOISTURE REGIME,**  
Canadian Wildlife Service, Saskatoon (Saskatchewan).  
J. B. Miller.  
Canadian Journal of Botany, Vol. 51, No. 8, p 1443-1457, August, 1973. 1 fig, 8 tab, 21 ref.

Descriptors: \*Freshwater marshes, \*Potholes, \*Succession, \*Moisture, \*Rooted aquatic plants, \*Submerged plants, Wetlands, Flooding, Marsh management, Canada, Vegetation establishment, Ecology, Ecological distribution.

Decreases in density of shallow marsh emergents in wetlands of the grassland and parkland regions of Saskatchewan occurred with greater than normal water depth at the start of the growing season. Two or more years of continuous flooding or repeated autumn reflooding were required to eliminate emergent cover completely. Changes in species composition occurred when basins were grazed and as vegetation reestablished after cultivation, but no change followed mowing or burning. Certain plants were designated 'disturbance' species on the basis of their response to soil exposure. Species composition of rooted submergents in a wetland can be used as an indicator of its moisture regime. Shallow marsh wetlands in basins of 1 ac (0.41 ha) or less experienced little year-long flooding and converted to open water only under atypical conditions. Larger wetlands required basin depths to excess of 30 in (96.4 cm) to have any amount of year-long flooding and to convert to open water. These basin size and depth criteria have applications in habitat evaluations by waterfowl managers. (Howard-Mass)  
W79-03735

**ROOT PRODUCTION AND ROOT TURNOVER IN A WET TUNDRA ECOSYSTEM, BARROW, ALASKA,**  
Duke Univ., Durham. Dept. of Botany.  
G. R. Shaver, and W. D. Billings.  
Ecology, Vol. 56, No. 2, p. 401-409, Early Spring, 1975. 8 fig, 4 tab, 22 ref.

Descriptors: \*Tundra, \*Root systems, \*Rooted aquatic plants, \*Biomass, \*Turnovers, Plant growth, Wetlands, Productivity, Soil temperature, \*Alaska, Ecology, Graminoids, Sedges.

Production of new roots by three species of graminoids in the wet tundra near Barrow, Alaska, was found to be strongly correlated with age of individual tillers, each species having a distinctive growth pattern and phenology. Root turnover rates also varied considerably with a range from an annual turnover to 6 to 8 (10) years. An estimate of root turnover on an ecosystem basis is about 100 g/sq m per year, or 25% of the live root biomass. Species with the shallowest and longest lived roots have the greatest weight per unit length of root, and vice versa. Each species has a characteristic

root distribution pattern with depth and in relation to the progress of soil thaw. (Howard-Mass)  
W79-03736

**PRIMARY PRODUCTION AND LIFE HISTORY OF CAREX LACUSTRIS,**  
Ithaca Coll., NY. Dept. of Biology.  
J. M. Bernard, and J. G. MacDonald, Jr.  
Canadian Journal of Botany, Vol. 52, No. 1, p. 117-123, January, 1974. 7 fig, 1 tab, 17 ref.

Descriptors: \*Freshwater marshes, \*Rooted aquatic plants, \*Productivity, \*Standing crops, \*Life history studies, Ecology, Marshes, Wetlands, Roots, \*New York, Sedges.

In a *Carex lacustris* wetland, seasonal aboveground standing crops of 180 g/sq m in winter and 1037 g/sq m maximum in summer were determined. Seasonal aboveground production was estimated at 857 g/sq m per year with a maximum daily production of 15 g/sq m. A second estimate taking into account the high shoot mortality during the growing season provided values of 1580 g/sq m per year for seasonal aboveground production and 20.3 g/sq m for maximum daily production. Belowground standing crop was 387 g/sq m in winter and declined to an average summer low of 226 g/sq m. Belowground standing crop increased during autumn and, by October 7, a value equal to the previous winter's value was reached. Shoots of *Carex lacustris* live for one year or less, emerging in autumn, overwintering, and then dying during the next summer. (Howard-Mass)  
W79-03737

**COMPARATIVE GROWTH AND FOLIAR ELEMENT CONCENTRATIONS OF LARIX LARICINA OVER A RANGE OF WETLAND TYPES IN MINNESOTA,**  
Minnesota Univ., St. Paul. Dept. of Botany.

D. L. Tilton.  
Journal of Ecology, Vol. 66, No. 2, p 499-512, July, 1978. 3 fig, 7 tab, 44 ref.

Descriptors: \*Wetlands, \*Deciduous trees, \*Plant growth, \*Nutrients, \*Soil-water-plant relationships, Fertility, Soil properties, Soil moisture, Soil types, Freshwater marshes, Marshes, Swamps, Bogs, Fen, \*Minnesota, Nitrogen, Phosphorus, Magnesium, Manganese, Calcium.

Needle and lateral shoot length, stemwood radial increment and site index of *Larix laricina* in Minnesota were lower in acid, nutrient-poor bogs than in circum-neutral, relatively nutrient-rich fens. Variation in these growth measures was positively correlated with foliar concentrations of N and, to a lesser extent, P. Nitrogen and P concentrations in the foliage were positively correlated with specific conductivity of the soil water at a site, and inversely correlated with site wetness. Foliar concentrations of Ca were also positively correlated with specific conductivity, while Mg concentrations in the foliage were positively correlated with soil water pH and specific conductivity. Manganese concentrations were inversely related to soil water pH. (Howard-Mass)  
W79-03739

**MORTALITY AND INITIAL PROPAGULE SIZE IN MANGROVE SEEDLINGS IN PANAMA,**  
Chicago Univ., IL. Dept. of Biophysics and Theoretical Biology.

D. Rabinowitz.  
Journal of Ecology, Vol. 66, No. 1, p. 45-51, March, 1978. 3 fig, 2 tab, 17 ref.

Descriptors: \*Mangrove swamp, \*Reproduction, \*Mortality, \*Size, Wetlands, Swamps, Brackish water, Longevity, Ecology, Age, Life cycle, \*Panama.

The mortality rate of mangrove seedlings in Panama was inversely correlated with initial propagule size. The species with small propagules appear to establish new cohorts annually but die

quickly, while those with larger propagules have overlapping cohorts on the swamp floor.  
W79-03740

**BREEDING BIRDS OF RIPARIAN WOODLAND IN SOUTH-CENTRAL ARIZONA,**  
Arizona State Univ., Tempe.

N. E. Stamp.  
Condor, Vol. 80, p. 64-71, 1978. 3 fig, 3 tab, 24 ref.

Descriptors: \*Birds, \*Riparian land, \*Habitats, \*Vegetation effects, Riparian plants, Wetlands, Ecology, Cottonwoods, Mesquite, \*Arizona, Ecological distribution.

Bird species diversity (BSD) of cottonwood and mesquite habitats of the Southwest appear to be correlated with foliage height diversity (FHD). For cottonwood habitats in Arizona, BSD was correlated with percent vegetative cover (PVC), a measure of foliage volume (FV). BSD was weakly correlated with FV, determined by the point-quarter method for riparian woodland habitats on the Verde River in Arizona. FHD, PVC and FV appear to be indefinite predictors of BSD. Breeding birds should be censused on study plots for consecutive years due to fluctuations in species diversity from year to year with seasonal measurements of habitat structure, fruit crops, and other resources to determine the relationship between vegetative structure and avian populations. (Howard-Mass)  
W79-03741

**BIRDS AND MAMMALS OF SALT MARSHES AND SALT STEPPES IN SOUTHERN SLOVAKIA (CSSR),**

Slovenska Akademie Vied, Bratislava (Czechoslovakia), Ustav Biologie Kraniny.  
For primary bibliographic entry see Field 2L.  
W79-03744

**AN ANALYSIS OF LAKE LEVEL INFLUENCE ON VEGETATION IN LAKE CHAMPLAIN,**  
Aquatec, Inc., South Burlington, VT.

For primary bibliographic entry see Field 2H.  
W79-03745

**SUMMARY OF AVAILABLE INFORMATION ON CHESAPEAKE BAY SUBMERGED VEGETATION,**

Maryland Univ., Cambridge. Horn Point Environmental Lab.

J. C. Stevenson, and N. M. Confer.  
Fish and Wildlife Service, Office of Biological Sciences, FWS/OBS-78/66, August, 1978. 335, 50 fig, 88 tab, 747 ref.

Descriptors: \*Submerged plants, \*Bays, \*Ecological distribution, Environmental effects, Aquatic plants, Estuaries, Pondweeds, Wedgeon grass, Aquatic weeds, Rooted aquatic plants, Aquatic environment, Distribution patterns, Model studies, Publications, Plant ecology, Effluents, Wastes, Water pollution effects, Heavy metals.

There are approximately eleven species of submerged aquatic vegetation (SAV) dominant in the waters of the Chesapeake Bay. These species tend to inhabit the shallow, shoreline areas of the Bay and its subestuaries, primarily limited to depths of three meters or less. Species vary as to salinity and temperature tolerances, morphology, preferred bottom substrate, susceptibility to chemical pollutants and general distribution. In order to determine the probable cause or cause for the changing patterns in submerged vegetation, the various factors that are known to affect the grasses have been analyzed to the extent possible given the availability of published and unpublished literature. Included among these factors are: agrochemicals, turbidity, salinity, temperature, pH, wave action, fauna, epiphytes, bicarbonate ion, chlorine, diseases, boat dredging, nutrient loading, petroleum and heavy metals. In order to assess these impacts and correlate them to a Baywide decline in submerged grasses, environmental factors can be initially separated into short-term, localized impacts or factors

## Field 2—WATER CYCLE

### Group 21—Water In Plants

that impact the Bay as a whole or on an aggregate basis such as the upper, middle, or lower Bay areas. Once the relative impacts of the known factors applicable to SAV growth and development have been analyzed, it becomes possible to apply mathematical modeling techniques to the Bay estuarine system. (Steiner-Mass)  
W79-03746

#### SEASONAL IONIC FLUCTUATIONS IN A PHRAGMITES COMMUNIS COMMUNITY, Carleton Univ., Ottawa (Ontario). Dept. of Biology.

I. L. Bayly, and T. A. O'Neill. Canadian Journal of Botany, Vol. 50, No. 10, p. 2103-2109, 1972. 7 fig. 28 ref.

Descriptors: \*Marsh plants. \*Nutrients. \*Plant growth. Wetlands. Marshes. Calcium, Magnesium, Potassium, Sodium, Phosphorus, Grasses.

Calcium, magnesium, potassium, sodium, and phosphorus concentrations were measured in the shoots of a *Phragmites communis* community and its natural substrates during the growth season of 1969. Shoot length and shoot moisture were determined as indicators of physiological age. In addition, organic decay was followed by determination of the soil organic matter content and cation exchange capacity. Of the ions studied, calcium apparently increased in the shoot tissue, and magnesium, potassium, and phosphorus apparently decreased in the shoot tissue during the course of the growing season. Some speculations regarding the direction of net nutrient flow in this community are advanced. (Steiner-Mass)  
W79-03747

#### ECOSYSTEM AND MACROPHYTE PRIMARY PRODUCTION OF THE FORT RIVER, MASSACHUSETTS.

Amherst Coll., MA. Dept. of Biology. S. G. Fisher, and S. R. Carpenter. Hydrobiologia, Vol. 49, No. 2, p. 175-187, May 31, 1976. 4 fig. 6 tab. 52 ref.

Descriptors: \*Aquatic plants. \*Primary productivity. \*Ecosystems. \*Massachusetts. Rivers, Food webs. Decomposition, Streams, \*Fort River(Mass).

Whole ecosystem gross primary production in the Fort River, measured using diurnal oxygen techniques, ranged from 0.44 g O<sub>2</sub>/sq m per day in winter to 6.50 g O<sub>2</sub>/sq m per day for 12 months. Mean ecosystem respiration was 3.65 g O<sub>2</sub>/sq m per day for 12 months. Macrophyte gross production (59.9 g O<sub>2</sub>/sq m per year) constitutes 9.2 percent of annual ecosystem productivity and 15.2 percent of summer primary production. Macrophytes were little grazed and entered food webs only after death, as detritus. Decomposition occurred near the site of production at relatively rapid rates, thus transport of dead macrophyte material in stream water was low. Data from this and other stream ecosystems suggest that, in general, streams are only moderately productive ecosystems which depend to varying degrees on watershed derived organic matter inputs. (Howard-Mass)  
W79-03748

#### PHENOLOGY, DISTRIBUTION, AND SURVIVAL OF ATRIPLEX TRIANGULARIS WILLD. IN AN OHIO SALT PAN.

Ohio Univ., Athens. Dept. of Botany. K. A. McMahon, and I. A. Ungar. The American Midland Naturalist, Vol. 100, No. 1, p. 1-14, July, 1978. 4 fig. 7 tab. 33 ref.

Descriptors: \*Salt marshes. \*Rooted aquatic plants. \*Life history studies. \*Ecological distribution. \*Phenology. Saline soils. Soil moisture. Soil temperature. Wetlands. Ecology. \*Ohio. Competition.

Germination of *Atriplex triangularis* Willd. occurred between February and May in an Ohio salt pan. Flowers appeared in mid-July; seed development began in September. Senescence and death

followed in late October. Soil Temperature of 15 degrees C appeared to trigger germination. High soil moisture values with consequent low soil salinity were prevalent during the germination period. Seedling establishment was particularly sensitive to salinity with severe mortality occurring in late spring and early summer when soil salinity began to climb. The highest concentration of soil salts coincided with the flowering stage in July and August when soil moisture values dropped severely due to low rainfall and high evaporation. By the seed development and maturation stage in September, soil moisture levels had begun to rise and total soil salts decreased. Of the four vegetation zones in the salt pan, germination and survival of *A. triangularis* were restricted in the main to the *Atriplex* zone. The establishment of *A. triangularis* in the Meadow and *Hordeum* zones was hindered by competition from other vegetation. High soil salinity within the Pan zone prevented germination of *A. triangularis*. (Howard-Mass)  
W79-03749

#### ANNUAL METABOLISM OF A TEMPORARY POND ECOSYSTEM,

Cornell Univ., Ithaca, NY. Section of Ecology and Systematics.

J. Cole, and S. G. Fisher. The American Midland Naturalist, Vol. 100, No. 1, p. 15-22, July, 1978. 3 fig. 1 tab. 25 ref.

Descriptors: \*Ponds. \*Seasonal. \*Productivity. \*Rooted aquatic plants. Respiration, Wetlands, Ecology. Plankton, Aquatic plants, Aquatic animals, \*Massachusetts, \*Ecosystem, Ecology, Water level fluctuations, Water level, Metabolism.

Whole ecosystem gross primary production and ecosystem respiration in Lost Pond, Massachusetts, estimated by diurnal oxygen techniques, were 2140 and 2669 kcal sq m per year, respectively. The plankton component represents only a small fraction of ecosystem metabolism. The benthic component, consisting of macrophytes, epiphytes, and sediment organisms, is the most active metabolic component of the ecosystem, particularly during the ice-free season. Macrophytes represent the major autochthonous organic matter input to Lost Pond. The fluctuating water level, by periodically exposing macrophytes, appears to exert a controlling influence on macrophyte decomposition and, therefore, may indirectly control the availability of certain nutrients in the water column. (Howard-Mass)  
W79-03750

#### NUTRIENT AND WATER LEVELS IN A SMALL MICHIGAN BOG WITH HIGH TREE MORTALITY.

Michigan Univ., Pellston. Biological Station. C. R. Schwintzler.

The American Midland Naturalist, Vol. 100, No. 2, p. 441-451, October, 1978. 3 tab. 39 ref.

Descriptors: \*Bogs. \*Nutrients. \*Water levels, Wetlands. Ecology. \*Michigan, Peat, Trees, Potassium, Nitrogen, Phosphorus, Calcium, Magnesium, Vegetation.

Bryant's Bog consists of two concentric zones, a free-floating and a grounded mat surrounding a central pool. The vegetation of the two zones differed in species composition, biomass and extent of tree mortality from 1969-1975. The grounded mat had less biomass and more tree mortality. Midsummer values in 1974 and 1975 of 17 chemical and physical parameters of shallow groundwater (15-30 cm below the surface) were not significantly different (P greater than 0.05) between the two zones or the two summers. The shallow groundwater had the low Ca + Mg concentrations characteristic of ombrotrophic bogs, moderately acid pH values characteristic of weakly minerotrophic bogs, and moderate concentrations of K, P and N. The Ca + Mg and pH values were comparable to those in six other bogs in the area while K, P and N concentrations were noticeably higher in Bryant's Bog. The pattern of tree mortality was consistent with changes in water levels in lakes and streams in the region. Depth from the surface to

the water level was significantly greater on the free than the grounded mat. Variations in water levels are the most probable cause of tree mortality and differences in vegetation of the two zones. (Howard-Mass)  
W79-03751

#### THE EFFECTS OF DITCHING A SALT MARSH ON COLONY AND NEST SITE SELECTION BY HERRING GULLS (LARUS ARGENTATUS), Livingston Coll., New Brunswick, NJ. Dept. of Biology.

For primary bibliographic entry see Field 6G. W79-03752

#### MINERAL CONCENTRATIONS IN PAPYRUS IN VARIOUS AFRICAN SWAMPS, Nairobi Univ. (Kenya). Dept. of Botany.

J. J. Gaudet. Journal of Ecology, Vol. 63, No. 2, p. 483-491, July, 1975. 1 fig. 8 tab. 12 ref.

Descriptors: \*Swamps. \*Environmental effects, \*Nutrients, Wetlands, Marsh plants, Grasses, Distribution, Standing crop, Papyrus.

Papyrus swamps are generally located in areas of equatorial climate where winter-summer seasonal differences are small. But at the latitudinal limits of the present range of papyrus in Africa, winter and summer seasons become evident. Plants collected during the winter season north of the equator at Lake Tana in Ethiopia, and south of the equator on the Shire River in Malawi contain lower levels of most elements. Standing crop could well be lower for papyrus populations in such regions, and this in turn might affect the level of nutrient uptake. The mean mineral concentrations and range in concentration in papyrus are like those of other swamp emergents in that they are low compared to other aquatics. (Steiner-Mass)  
W79-03753

#### THE RELATIONSHIP BETWEEN STANDING CROP IN SEDGE MEADOWS AND SUMMER TEMPERATURE.

Minnesota Univ., Minneapolis. Dept. of Botany. E. Gorham.

Journal of Ecology, Vol. 62, No. 2, p. 487-491, July, 1974. 1 fig. 1 tab. 15 ref.

Descriptors: \*Marsh plants, \*Standing crop, \*Temperature, Wetlands, Growth rate, Heat, Seasonal, Summer, Productivity, Marshes.

Despite low values in extreme northern and montane sites, sedge standing crop is not significantly correlated with length of growing season. It is, however, closely correlated with the highest monthly mean temperature. *Carex bigelowii* at 1840 m on Mt. Washington experienced about 260 degree-days to reach a peak standing crop of about 180 g/sq m in midsummer. *C. rostrata* at 1455 m in the Canadian Rockies experienced about 680 degree-days to reach a midsummer peak of about 750 g/sq m, whereas *C. rostrata* in Minnesota experienced about 1290 degree-days to reach about 1100 g/sq m in midsummer. The highly productive stand of *C. lacustris* in New York State experienced about 1770 degree-days to peak at 1470 g/sq m in mid-September. There is a strong correlation, therefore, between standing crop and heat-unit accumulations, despite the limitations of the heat-unit concept. (Steiner-Mass)  
W79-03754

#### CHEMICAL INPUTS BY A COLONY OF FRANKLIN'S GULLS NESTING IN CATTAILS, Minnesota Univ., St. Paul. Dept. of Ecology and Behavioral Biology.

J. G. McColl, and J. Burger. The American Midland Naturalist, Vol. 96, No. 2, p. 270-280, October, 1976. 2 fig. 4 tab. 23 ref.

Descriptors: \*Freshwater marshes, \*Cattails, \*Nutrients, \*Gulls, Life cycles, Ecology, Marshes, Wetlands, Nitrogen, Potassium, Sodium, Magnesium.

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## WATER CYCLE—Field 2

### Erosion and Sedimentation—Group 2J

sium, Calcium, Sediments. Rooted aquatic plants, Wildlife.

Large increases occurred in N and P concentrations of water in the immediate vicinity of a nesting Franklin's gull colony in Agassiz National Wildlife Refuge, Minnesota. Peak concentrations were concomitant with the peak of gull nestbuilding and feeding activities in mid-May and mid-July. About 36% of the annual P input to the pool with the gull colony is attributable to the gulls. Nutrient concentration in inflow and outlet water of both the pool with a gull colony and one without remained relatively constant throughout the year due to nutrient absorption by the pool sediments. The gull colony had little effect on the concentrations of Na, K, Ca, and Mg in water. Outlet waters of both pools had higher K concentrations than inputs due to release of the element by the sediments to water or by nutrient uptake by cattails and subsequent leaching of both dead and living cattails. Most nutrients accumulated in the sediments, especially in the pool with the gull colony. The Refuge acts as a sink for nutrients in runoff from surrounding agricultural land. (Howard-Mass)  
W79-03755

**HABITAT SELECTION BY WATERFOWL OF ARGENTINE ISLA GRANDE,**  
Iowa State Univ., Ames. Dept. of Zoology and Entomology.  
M. W. Weller.  
Wilson Bulletin, Vol. 87, No. 1, p. 83-90, March, 1975. 1 fig, 1 tab, 13 ref.

Descriptors: \*Waterfowl, \*Habitats, \*South America, Ducks, Geese, Swans, Marshes, Estuaries, Lakes, Broods, Wetlands, \*Argentine Isla Grande.

During a month-long study of habitat selection and of seedling behavior of waterfowl, 15 of the 17 species of waterfowl known to occur on the island were seen. Habitat segregation of breeding waterfowl was quite distinctive and resembled the pattern of the same species in the Falkland Islands. Different species of Sheldgeese, associated with various habitat types including exposed rocky seashore, shortgrass meadows in open or semiwooded country, and streams and lakes in densely wooded areas, during the breeding season, are a good example of presumed ecological isolation. In estuarine areas, steamer ducks, which feed by diving, have little overlap in food use with dabbling ducks of the genus *Anas*. Dabbling ducks overlapped most in freshwater marshes but, even there, seemed to be segregated by feeding sites and feeding behavior. (Howard-Mass)  
W79-03756

**PRIMARY PRODUCTION IN THE FRESHWATER MARSH ECOSYSTEM OF TROY MEADOWS, NEW JERSEY,**  
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Botany.  
For primary bibliographic entry see Field 2H.  
W79-03758

**PRODUCTION, NUTRIENT CONTENT AND DECOMPOSITION OF PHRAGMITES COMMUNIS TRIN. AND TYPHA ANGUSTIFOLIA L.,**  
University of East Anglia, Norwich (England). School of Biological Sciences.  
F. F. Mason, and R. J. Bryant.  
Journal of Ecology, Vol. 63, No. 1, p. 71-95, March, 1975. 5 fig, 12 tab, 45 ref. 1 append.

Descriptors: \*Freshwater marshes, \*Productivity, \*Nutrients, \*Decomposing organic matter, Cattails, Reeds, Wetlands, Swamps, Marshes, Eutrophication, Europe, Rooted aquatic plants, Aquatic plants.

Shoots of Phragmites and Typha emerged in April in reeds in Alderfen Broad, Norfolk. The peak shoot density of Phragmites, occurring in

July, was 127/sq m in 1972 but decreased to 72/sq m the following year due largely to grazing by coypus. Loss of dead standing shoots occurred mainly in the spring and summer—some dead shoots surviving for over two years. Typha shoots reached a maximum density of 100/sq m in May 1973 and thereafter declined steadily through a self-thinning process. The peak standing crop of Phragmites was 942 g dry wt/sq m in 1972 and 524 g/sq m in 1973 and that of Typha 1118/sq m in 1973. The net productivity was estimated as 1080 g/sq m and 551 g/sq m in the two years for Phragmites and 1445 g/sq m for Typha in 1973. Growing shoots of Phragmites and Typha showed marked and different seasonal changes in nutrient content; seasonal changes in rhizomes were also detected. Phragmites decomposed at a faster rate than Typha. The reedswamp released large amounts of nutrients into Alderfen Broad during the winter. (Howard-Mass)  
W79-03759

**AN INVESTIGATION OF THE BIOTIC FACTORS DETERMINING THE RATES OF PLANT DECOMPOSITION ON BLANKET BOG,**  
Durham Univ. (England). Dept. of Zoology.  
J. C. Coulson, and J. Butterfield.  
Journal of Ecology, Vol. 66, No. 2, p. 631-650, July, 1978. 15 tab, 16 ref.

Descriptors: \*Bogs, \*Peat, \*Decomposing organic matter, Rates, \*Soil types, Organic matter, Wetlands, Ecology, Aquatic plants, Microbial degradation, Soil micro-organisms, Invertebrates, Insects, Nutrients, Nitrogen, Phosphorus, Fertilization, Europe.

The chemical composition of a plant species is of paramount importance in determining the rate of its decomposition on blanket bog in the northern Pennines. Peat accumulation is primarily the result of the intrinsic slow decay rate of some of the species in the plant community. The average rate of microbial decomposition of the same substrates was similar at peat and at mineral soil sites. The role of animals in the decomposition of plant materials differed markedly according to both the soil type and the plant species of the substrate. The decomposition losses attributed to microorganisms and to animals were not significantly correlated. Compared to mineral soils, peat contained a lower overall density of soil animals. The rates of microbial decomposition were highly correlated with the plant P or N concentration on both soil types. When animal contribution to decomposition was included this correlation became nonsignificant on the peat. Plant material enriched with N showed increased decomposition rates while that enriched with P did not. (Howard-Mass)  
W79-03760

**GEOGRAPHICAL VARIATION IN BRITISH SALTMARSH VEGETATION,**  
Cambridge Univ. (England). Botany School.  
P. Adam.

Journal of Ecology, Vol. 66, No. 2, p. 339-366, July, 1978. 5 fig, 94 ref. 2 append.

Descriptors: \*Salt marshes, \*Vegetation, Regions, Europe, Marshes, Wetlands, Ecology, Plant populations, Ecological distribution, Aquatic plants.

Three types of saltmarshes around the British coast were recognized from cluster analysis and principal coordinates analysis of the nodes occurring at 133 marsh sites. One type is largely restricted to south-east England and at present is normally ungrazed. A second type is largely restricted to the Irish Sea coast of England and Wales and most examples are grazed. The third type is characteristic of loch-head marshes on the west coast of Scotland. It is suggested that the saltmarsh types have arisen through the interaction of sediment type, climatic, biotic and historic factors. Of these, the most important determinant of the vegetation types on saltmarshes in England and Wales is past and present land use. A regional differentiation of saltmarsh vegetation into four major 'natural' types is postulated. (Howard-Mass)  
W79-03761

**ALGAE IN CULTURE AND NATURE,**  
Uppsala Univ. (Sweden). Inst. of Limnology.  
For primary bibliographic entry see Field 5C.  
W79-03843

### 2J. Erosion and Sedimentation

**RETARDATION OF SEDIMENT PHOSPHORUS RELEASE BY FLY ASH APPLICATION,**  
Notre Dame Univ. IN.  
For primary bibliographic entry see Field 5C.  
W79-03560

**SCOUR AND FILL PATTERNS IN POOL-RAPID RIVERS,**  
Arizona Univ. Tucson. Dept. of Civil Engineering and Engineering Mechanics.  
E. Silverton.

Available from the National Technical Information Service, Springfield, VA. 22161 as PB-290 584. Price codes: A05 in paper copy, A01 in microfiche. Master of Science Thesis, 1975. 85p. 36 fig, 1 tab, 7 ref, append. OWRT A-038-ARIZ(1), 14-31-0001-4003.

Descriptors: Degradation, Erosion, \*Scour, Rivers, River flow, Sediments, \*Sediment transport, \*Distribution patterns, River behavior, Stream morphology.

Sediment carrying pool-rapid rivers are abundant in the United States. However, not much is known about the behavior of the pool beds. It is known that with an increase in the flow that sediment eventually is scour from the bed and when the flow is decreased the bed elevation eventually increases, but what actually occurs before the final equilibrium bed configuration is attained can only be approximated. It is a reasonable assumption that the bed elevation fluctuates due to scour and deposition, until the final equilibrium bed configuration is attained. An approximate analysis of the scour and fill patterns of the pool-rapid river was made to predict the scour and fill patterns of pool-rapid rivers. A numerical model was analyzed to better account for what actually happens to the pools. The results of the analysis verified that when there was a change in the flow that the pool bed had fluctuated by scouring or filling, and that the time period until equilibrium would occur varied by several orders of magnitude.  
W79-03668

**TRANSPORT OF A NONCOHESIVE SANDY MIXTURE IN RAINFALL AND RUNOFF EXPERIMENTS,**  
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia).  
P. H. Walker, P. I. A. Kinnell, and P. Green.  
Soil Science Society of America Journal, Vol. 42, No. 5, p 793-801, September-October 1978. 8 fig, 3 tab, 20 ref.

Descriptors: \*Impact(Rainfall), \*Soil erosion, \*Bed load, \*Suspended solids, Erosion, Laboratory tests, Simulated rainfall, Particle size, Rainfall, Runoff, Erosion, Soils, Sands, Sediment transport, Flow, Storms, Precipitation(Atmospheric), Soil science.

Rainfall intensities of 45, 100, and 150 mm/hr with systematically varied kinetic energies were applied to a saturated noncohesive, sandy bed 3 m long and set at slopes of 0.5 and 5%. Detailed size analyses of solids discharged showed that the less than 31-micrometer fraction was mobilized most readily and behaved as a suspended load; the 31- to 250-micrometer fraction was transported slowly, much apparently as saltating bed load; the 0.25- to 4-mm fraction was transported rapidly, grains tending to move as rolling bed load; the greater than 4-mm fraction behaved as a lag gravel. The sedimentary properties of bed deposits also reflected the differentiation of various size fractions and minerals in the original mixture. The effects of raindrop impacts within the flow were more important in promoting transport of solids than the aerial component of splash. Under conditions where overland flow had developed, transport of

## Field 2—WATER CYCLE

### Group 2J—Erosion and Sedimentation

solids was related directly to rainfall intensity and variations in rainfall energy that were associated with variations in raindrop impact frequency. Increases in rainfall energy due to increasing raindrop sizes did not result in increases in solids discharged. (Sims-ISWS)  
W79-03804

**THEORETICAL MODEL OF THE LITTORAL DRIFT SYSTEM IN THE TORONTO WATER-FRONT AREA, LAKE ONTARIO,**  
Scarborough Coll., Toronto (Ontario).  
For primary bibliographic entry see Field 2H.  
W79-03811

**POLYCHLORINATED BIPHENYLS: ACCUMULATION FROM CONTAMINATED SEDIMENTS AND WATER BY THE POLYCHAETE NEREIS DIVERSICOLOR,**  
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.  
For primary bibliographic entry see Field 5C.  
W79-03904

**EFFECTS OF SEDIMENTS ON THE DEVELOPMENT OF MACROCYSTIS PYRIFERA GAMETOPHYES,**  
University of Southern California, Los Angeles. Environmental Engineering Program.  
For primary bibliographic entry see Field 5C.  
W79-03905

**SAND AND GRAVEL OFFSHORE IN THE GREATER NEW YORK METROPOLITAN AREA: WHAT KIND AND HOW MUCH,**  
New York Sea Grant Inst., Albany.  
For primary bibliographic entry see Field 2L.  
W79-03963

**WIND EROSION AND DEPOSITION ALONG A COASTAL SAND DUNE,**  
Delaware Univ., Newark. Coll. of Marine Studies. R. J. Lai, and J. Wu.  
Sea Grant Technical Report No. DEL-SG-10-78, September 1978. 31 p. 9 fig. 17 ref.

Descriptors: \*Erosion, \*Deposition(Sediments), \*Dunes, \*Wind erosion, Sediment transport, Coasts. Laboratory tests, Wind force.

When wind blows over a coastal dune, the effective wind force and sand-transport rate vary significantly along the surface of the dune. Erosion and deposition of sand along the dune surface depend on dynamic wind force, local dune geometry, and sand-grain size. These parameters have been studied from laboratory modeling and numerical calculation. The results indicate that erosion depends strongly on wind velocity and local slope of the dune surface. Furthermore, while it affects only slightly the total sand transport rate from the dune, the size of the sand grains significantly affects the distribution of the transport rate and, consequently, the erosion and deposition areas along the dune. (NOAA)  
W79-03965

## 2K. Chemical Processes

**ALIPHATIC ACID ANIONS IN OIL-FIELD WATERS—IMPLICATIONS FOR ORIGIN OF NATURAL GAS,**  
Geological Survey, Menlo Park, CA. Water Resources Div.  
For primary bibliographic entry see Field 1A.  
W79-03558

**CYCLIC WETTING AND DRYING OF THE SOIL ZONE AS AN INFLUENCE ON THE CHEMISTRY OF GROUND WATER IN ARID TERRAINS,**  
Wyoming Univ., Laramie. Dept. of Geology; and Geological Survey, Denver, CO. Geologic Div. J. I. Drever, and C. L. Smith.

American Journal of Science, Vol 278, p 1448-1454, December 1978. 6 fig, 1 tab, 8 ref.

Descriptors: \*Chemical reactions, \*Soil water, \*Wetting, \*Drying, \*Arid lands, Rainfall, Cloud-bursts, Saline soils, Solutes, Evaporation, Salts, Laboratory tests, Analytical techniques, Leaching, Groundwater, Springs, \*Re-solution of salts.

In arid climates, occasional heavy rains cause partial re-solution of salts deposited in the soil and vadose zone. The kinetics of re-solution of these salts were studied in the laboratory by evaporating waters of different composition in a sand tray and then leaching the sand with distilled water. The relative rates of dissolution were Na and Cl most rapid, the K, SO<sub>4</sub>, Mg, Ca, carbonate species and finally SiO<sub>2</sub>. Processes of evaporation followed by re-solution can give rise to a solution composition depleted in SO<sub>4</sub>, Mg, and SiO<sub>2</sub> relative to chloride, even though the solution is undersaturated with respect to minerals containing these elements. The process explains well the chemistry of springs in the Tees Marsh Basin, Nev., and may complicate mass balance calculations relating water chemistry to rock weathering. (Woodard-USGS)  
W79-03584

**PARAQUAT SORPTION AS A FUNCTION OF PARTICLE SIZE IN NATURAL SEDIMENTS,**  
Environmental Research Lab., Athens, GA.  
For primary bibliographic entry see Field 5B.  
W79-03595

**NITRATE ACCUMULATION IN SOILS AND LOSS IN TILE DRAINAGE FOLLOWING NITROGEN APPLICATIONS TO CONTINUOUS CORN,**

Minnesota Agricultural Experiment Station, St. Paul. R. G. Gast, W. W. Nelson, and G. W. Randall. Journal of Environmental Quality, Vol. 7, No. 2, p 258-261, April-June, 1978. 1 fig, 4 tab, 9 ref.

Descriptors: \*Nutrient removal, \*Denitrification, Nitrates, \*Tile drainage, Water pollution, Sweet corn.

Nitrate-N concentration in tile water, loss from tile lines, and accumulation in soil profiles were determined following each of three annual applications of 20, 112, 224, and 448 kg N/ha to continuous corn (*Zea mays* L.) grown on a Webster clay loam (*Typic Haplauqoli*) in southern Minnesota. Plots were isolated to a depth of 1.8 m with plastic to allow an accurate assessment of the area drained. There was relatively little increased NO<sub>3</sub>-N accumulation in the soil profile or loss from tile lines at the recommended application rate of 112 kg N/ha compared to that for the check treatment. Nitrate-N losses through tile lines in 1975 (after 3 years treatment) were 19, 25, 59, and 120 kg/ha for the 20, 112, 224, and 448 kg N/ha applications, respectively, which had NO<sub>3</sub>-N accumulations in the 0-3 m soil profiles of 54, 100, 426, and 770 kg NO<sub>3</sub>-N/ha. Maximum NO<sub>3</sub>-N accumulation in the soil profiles occurred at a depth of about 1 m with little evidence of movement below about 2.2 m. (Skogerboe-Colorado State)  
W79-03653

**THE EFFECT OF HIGH 2, 4-D CONCENTRATIONS ON DEGRADATION AND CARBON DIOXIDE EVOLUTION IN SOILS,**

Florida Univ., Gainesville. Dept. of Soil Science; and Florida Univ., Gainesville. Dept. of Food Science and Human Nutrition.  
For primary bibliographic entry see Field 5B.  
W79-03678

**EFFECTS OF TRACE ELEMENTS ON NITRIFICATION IN SOILS,**

Iowa State Univ., Ames. Dept. of Agronomy.  
For primary bibliographic entry see Field 5A.  
W79-03705

**A GEOCHEMICAL STUDY OF A MARSH ENVIRONMENT,**

Gulf Coast Research Lab., Ocean Springs, MS. T. F. Lyle, J. S. Lyle, and P. L. Parker. Gulf Coast Research Reports, Vol. 4, No. 2, p 214-232, November, 1973. 6 fig, 5 tab, 17 ref.

Descriptors: \*Marsh plants, \*Salt marshes, \*Trace metals, \*Geochemistry, Wetlands, Marshes, Sediments, Metals, Organic matter, Gulf Coastal Plain, Soil contamination, Water pollution, Pollutant identification, Bioassay, Indicators, Soil analysis.

The marsh plants as a whole have exhibited an ability about as strong as terrestrial and marine plants in accumulating a variety of trace metals from their environment. In some cases the marsh plants may act as sources for trace metal enrichment in the sediments and in other instances, notably molybdenum, as an active depleting agent. The coastal marsh environment widespread among Gulf and Atlantic coastlines will undoubtedly continue to be a primary target of heavy metal pollution. The varying degrees of enrichment of the various elements both essential and nonessential in marsh plants should make them of value in establishing base-line evaluations of heavy metal inventories in a coastal area. (Steiner-Mass)  
W79-03743

**CHEMICAL INPUTS BY A COLONY OF FRANKLIN'S GULLS NESTING IN CATTAILS,**  
Minnesota Univ., St. Paul. Dept. of Ecology and Behavioral Biology.

For primary bibliographic entry see Field 2I.  
W79-03755

**DETERMINATION OF PHOSPHATE BY CATHODIC STRIPPING CHRONOPOTENTIOMETRY AT A COPPER ELECTRODE,**

Southern Illinois Univ., Carbondale. Dept. of Chemistry and Biochemistry.

For primary bibliographic entry see Field 5A.  
W79-03769

**VOLTAMMETRIC DETERMINATION OF TRACE QUANTITIES OF NITRATE IN AN ANION EXCHANGE MEMBRANE ISOLATED CELL,**

Southern Illinois Univ., Carbondale. Dept. of Chemistry and Biochemistry.

For primary bibliographic entry see Field 5A.  
W79-03771

**CHEMICAL CHARACTERIZATION OF THE GASEOUS AND LIQUID ENVIRONMENTS OF SUBSURFACE DRAIN SYSTEMS,**

Agricultural Research Service, Brawley, CA. Imperial Valley Conservation Research Center.

B. D. Meek, L. B. Grass, and A. J. MacKenzie. Soil Science Society of American Journal, Vol. 42, No. 5, p. 693-698, September-October 1978. 3 fig, 6 tab, 14 ref.

Descriptors: \*Subsurface drains, \*Chemical precipitation, \*On-site investigations, Solutes, Gases, Soil gases, Drainage systems, Tile drains, Tiles, Iron, Manganese, Chemicals, Oxygen, Dissolved oxygen, Carbon dioxide, Oxidation-reduction potential, Chemistry, Water chemistry, California, \*Imperial Valley(CA).

Chemical composition of subsurface drain effluents was determined in the field as a function of location (various depths and soil textures), entry point of the solution into the drainpipe, and distance from outlet (with or without a water trap). Liquid samples were analyzed for Fe, Mn, NO<sub>3</sub>-N, HCO<sub>3</sub><sup>-</sup>, organic carbon, electrical conductivity, pH, and dissolved oxygen, and gas samples were analyzed for O<sub>2</sub> and CO<sub>2</sub>. Manganese ranged from less than 0.1 to 6.1 ppm and Fe ranged from less than 0.1 to 14.2 ppm which illustrated the wide range of oxidation-reduction conditions present in the soils drained by subsurface drain lines. Chemical composition changed little during the season. Water entering the upper portion of the drain lines was lower in Mn, which was the result of short

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W79-0

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Surface Water

## Estuaries—Group 2L

flow paths through soil zones with higher O<sub>2</sub> levels, than the water moving through longer flowlines which entered the bottom of the drains. The solutions in the drain lines were undersaturated with respect to the drain line atmosphere, which indicated that O<sub>2</sub> flows downward through the drain trench backfill. This is an important factor in the oxidation of Fe and Mn in subsurface drain lines. However, longitudinal movement of O<sub>2</sub> into drain lines, via the outlets, is a minor factor contributing to the precipitation of Fe and Mn and does not account for the extensive amount of precipitation of Fe or Mn within the drain system. (Sims-ISWS) W79-03801

## SAMPLING OF GROUNDWATERS FOR CHEMICAL ANALYSIS,

Alberta Research Council, Edmonton. Groundwater Div.

E. Wallick.

In: Contributions to the Hydrogeology of Alberta, Bulletin 35, Alberta Research Council, Edmonton, p 19-30, 1977. 11 fig, 2 tab, 7 ref.

Descriptors: \*Sampling, \*Water chemistry, \*Chemical analysis, \*Groundwater, Surveys, Wells, Water wells, Chemicals, Headness(Water), Alkalinity, Iron, Silicates, Carbonates, Hydrogen ion concentration, Chemistry, Chemical reactions, Analytical techniques, Hydrogeology, Groundwater sampling.

Groundwater chemical systems are often unstable when exposed to surface conditions, so incorrect values for certain chemical parameters may result when samples are analyzed. Determination of the equilibrium chemical state of groundwater from the thermo-dynamic constants requires that input ionic concentrations be representative of field pressure and temperature conditions. Test samples from east-central Alberta showed that low values for hardness, alkalinity, and total iron were obtained if no attempt was made to preserve the samples. It was found that by collecting three samples, one untreated, one acidified to pH = 1 for laboratory analysis, and one untreated for field analysis of pH, temperature and conductivity, accurate determination of chemical components could be made. (See also W79-03819)(Sims-ISWS) W79-03822

## MINERALIZATION, IMMOBILIZATION AND NITRIFICATION,

California Univ., Davis. Dept. of Land, Air and Water Resources.

F. E. Broadbent.

In: National Conference on Management of Nitrogen in Irrigated Agriculture, p 109-134, 1978. 5 fig, 33 ref.

Descriptors: Nitrogen, \*Nitrification, Ammonia, Decomposing organic matter, Soil microorganisms, Inorganic compounds, Pollutants, Inhibitors, \*Mineralogy.

The decomposition of organic substances containing nitrogen through the activities of soil microorganisms and resulting in the release of some of the nitrogen as ammonia is called nitrogen mineralization. Net mineralization occurs when the quantity of nitrogen in the material undergoing decomposition exceeds the needs of the microbial population for nitrogen to produce new cells. If the decomposing substances do not contain enough nitrogen to meet the needs of the microbial population, any inorganic nitrogen present in the soil will be utilized by the microbes and converted to cell protein and other nitrogenous compounds. This process is called immobilization. In a sense the assimilation of inorganic nitrogen by growing plants is also immobilization, but this discussion considers only the microbial process. The nitrogen supplying capacity of soils depends to a large extent on rates of mineralization and immobilization. Various procedures have been utilized to obtain estimates of nitrogen mineralization over a growing season, the most successful of which have been based on incubation of soil samples under controlled conditions for a few weeks. Desirable management practices

should favor not only efficient utilization of fertilizer nitrogen, but also maximum crop uptake of mineralized nitrogen. Experiments with isotopically labeled fertilizers indicate that these two objectives are compatible with each other and also with the need to minimize leachable nitrate. (See also W79-03941) (Skogerboe-Colorado State) W79-03945

## COUPLING PHENOMENA IN SATURATED HOMO-IONIC MONTMORILLONITE: III. ANALYSIS,

Guelph Univ. (Ontario). Dept. of Land Resource Science.

For primary bibliographic entry see Field 2G. W79-03962

## ARSENIC DETERMINATION BY THE SILVER DIETHYLDITHIOCARBAMATE METHOD AND THE ELIMINATION OF METAL ION INTERFERENCE,

Clayton Coll., Orangeburg, SC.

For primary bibliographic entry see Field 5A.

W79-03962

## PROCEEDINGS OF THE SECOND WORKSHOP ON SAMPLING GEOTHERMAL EF-FLUENTS.

For primary bibliographic entry see Field 5A.

W79-03967

## 2L. Estuaries

## STIRRING INFLUENCES THE PHYTOPLANKTON SPECIES COMPOSITION WITHIN ENCLOSED COLUMNS OF COASTAL SEA WATER,

California Univ., San Diego, La Jolla. Inst. of Marine Resources.

For primary bibliographic entry see Field 5C.

W79-03512

## MONTHLY OXYGEN AND CARBON BUDGETS OF THE NEW YORK BIGHT APEX,

Lamont-Doherty Geological Observatory, Palisades, NY.

For primary bibliographic entry see Field 5B.

W79-03555

## WORKSHOP ON COPPER IN ESTUARINE, CONTINENTAL AND MARINE WATERS.

Department of Energy, Washington, DC. Div. of Biomedical and Environmental Research.

For primary bibliographic entry see Field 5C.

W79-03564

## THE EFFECT OF COMPETITION AND SALINITY ON THE GROWTH OF A SALT MARSH PLANT SPECIES,

California Univ., Davis. Dept. of Botany.

For primary bibliographic entry see Field 2I.

W79-03634

## DYNAMIC MODEL OF NUTRIFICATION IN HUNTINGTON BAY, NEW YORK,

Long Island Univ., Greenvale, NY. Dept. of Marine and Environmental Science.

For primary bibliographic entry see Field 5B.

W79-03638

## POLYCHLORINATED BIPHENYL (PCB) EFFECTS ON MARINE PHYTOPLANKTON PHOTOSYNTHESIS AND CELL DIVISION,

Stanford Univ., Pacific Grove, CA. Hopkins Marine Station.

For primary bibliographic entry see Field 5C.

W79-03650

## ENHANCEMENT OF SOCKEYE SALMON (ONCORHYNCHUS NERKA) BY LAKE FER-

## TILIZATION IN GREAT CENTRAL LAKE: SUMMARY REPORT,

Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station.

For primary bibliographic entry see Field 5C.

W79-03658

## CONTRIBUTED PAPERS ON COASTAL ECOLOGICAL CHARACTERIZATION STUDIES, FOURTH BIENNIAL INTERNATIONAL ESTUARINE RESEARCH FEDERATION CONFERENCE, OCTOBER, 1977.

Fish and Wildlife Service, Washington, DC. Office of Biological Services.

Report FWS/OBS-77/37, April, 1978. 66 p.

Descriptors: \*Systems analysis, \*Estuaries, \*Model studies, \*Coasts, Coastal plains, Ecology, Ecosystems, Wetlands, Management, Marsh management.

Six papers present, discuss, and give examples of the U. S. Fish and Wildlife Service's coastal ecological characterization. An ecological characterization is a description of the important components and processes of an ecosystem with an emphasis on the understanding of functional relationships. Characterizations will be available for use by all FWS programs related to coastal resource management and planning. Other applications are assessing the Outer Continental Shelf development, Coastal Zone Management, and Section 208 water quality planning. Characterizations will identify fish and wildlife populations and their habitats that could be impacted during ecological emergencies such as oil spills. (See W79-03698 thru W79-03703) (Steiner-Mass) W79-03697

## COASTAL ECOLOGICAL CHARACTERIZATION—AN OVERVIEW,

National Coastal Ecosystems Team, NSTL Station, MS.

J. B. Johnston.

In: Contributed Papers on Coastal Ecological Characterization Studies, Fourth Biennial International Estuarine Research Federation Conference, October, 1977. Fish and Wildlife Service, Office of Biological Services, FWS/OBS-77/37, April, 1978. p 1-3.

Descriptors: \*Coastal plains, \*Ecosystems, \*Systems analysis, Coasts, Structural models, Structure, Ecology, Hydrology, Land management, Productivity, Simulation analysis, Estuaries.

The U. S. Fish and Wildlife Service, in response to accelerated development pressures upon the coastal zone of the United States and its territories, has developed an ecological characterization approach for describing these valuable areas. Characterizations integrate functionally the major elements of an ecosystem. Elements include, but are not limited to, physiography and geology, climate, and physical transport mechanisms. Examples of physical transport mechanisms are hydrology, sediment flux, physical oceanography, energy flows and trophic relationships, and atmospheric transport. Characterizations describe the important species, populations, and communities in the ecosystem, with particular emphasis on those organisms perceived as being of importance (recreational or commercial) to man or vital to the natural functioning of the ecosystem being studied. Population estimates do not require precise statistical sampling, but where feasible, estimates are to address the extent and causes of natural variation. The main objective of a characterization is to describe socio-economic, physical, and biological features as interacting components, thereby establishing a foundation upon which impacts of man, including modifications to the ecosystem, can be predicted. (See also W79-03697)(Steiner-Mass) W79-03698

## ECOSYSTEM CHARACTERIZATION—AN APPROACH TO COASTAL PLANNING AND MANAGEMENT,

Fish and Wildlife Service, Washington, DC. Office of Biological Services.

## Field 2—WATER CYCLE

### Group 2L—Estuaries and Sedimentation

For primary bibliographic entry see Field 6A.  
W79-03699

#### EVALUATION OF METHODOLOGY USED IN ECOLOGICAL CHARACTERIZATION OF THE CHENIER PLAIN.

National Coastal Ecosystems Team, NSTL, St. Paul, MS.

For primary bibliographic entry see Field 6B.  
W79-03700

#### USER-ORIENTED CONCEPTUAL MODELING IN THE ECOLOGICAL CHARACTERIZATION OF THE SEA ISLANDS AND COASTAL PLAIN OF SOUTH CAROLINA AND GEORGIA.

South Carolina Wildlife and Marine Resources Dept., Charleston. Marine Resources Research Inst.

For primary bibliographic entry see Field 6A.

W79-03701

#### MAINE COAST CHARACTERIZATION USER'S GUIDE.

Energy Resources Co., Inc., Cambridge, MA.  
S. I. Fefer, C. Laffin, L. Thornton, P. Schettig, and R. Bram.

In: Contributed Paper on Coastal Ecological Characterization Studies, October, 1977. Fish and Wildlife Service, Office of Biological Services, FWS/OBS-77/37, p. 44-66, April, 1978. 12 fig, 4 tab, 13 ref.

Descriptors: \*Model studies, \*Systems analysis, \*Estuaries, Coasts, Coastal plains, Ecology, Ecosystems, Design, Wetlands, \*Maine.

The user's guide is part of the Maine Coast Ecological Characterization that will be completed in late 1979. It directs various users on how to manipulate the materials in the characterization to satisfy their specific needs. (See also W79-03697) (Steiner-Mass)  
W79-03703

#### ROOT PRODUCTION AND ROOT TURNOVER IN A WET TUNDRA ECOSYSTEM, BARROW, ALASKA.

Duke Univ., Durham. Dept. of Botany.  
For primary bibliographic entry see Field 21.  
W79-03736

#### MICROBIAL POPULATIONS IN FLOODED SWAMP SOILS OF SOUTH CAROLINA.

Southeastern Forest Experiment Station, Asheville, NC.

For primary bibliographic entry see Field 2G.  
W79-03742

#### A GEOCHEMICAL STUDY OF A MARSH ENVIRONMENT.

Gulf Coast Research Lab., Ocean Springs, MS.  
For primary bibliographic entry see Field 2K.  
W79-03743

#### BIRDS AND MAMMALS OF SALT MARSHES AND SALT STEPPES IN SOUTHERN SLOVAKIA (CSSR).

Slovenska Akademie Vied. Bratislava (Czechoslovakia). Ustav Biologie Kraniny.

F. J. Turcek. Biological Conservation, Vol. 9, No. 1, p. 29-36, January, 1976. 3 fig, 5 tab, 7 ref.

Descriptors: \*Salt marshes, \*Wildlife habitat, \*Saline soils, Wetlands, Birds, Mammals, Land use, Water pollution, Wildlife management.

Saline marshes and steppes along the Danube in southern Slovakia lie on the northern-most border of the complex of Central American saline soil. The ecology of the saline localities studied is outlined on the basis of 48 bird and 18 mammal species. Some birds are confined to the saline localities studied because they are relatively well conserved and extensive rather than because they are

saline. The root vole, *Microtus oeconomus*, known only from the area studied, and the lizard *Lacerta vivipara*, living in isolated populations in mountainous areas, are the only known vertebrate relicts. Some functional aspects of the animals studied are stressed. The saline localities are threatened by reclamation for agricultural use, by fire, drainage and lowering the underground water table, but primarily by pollution from both oily water and the dumping of reuse. (Steiner-Mass)  
W79-03744

#### SUMMARY OF AVAILABLE INFORMATION ON CHESAPEAKE BAY SUBMERGED VEGETATION,

Maryland Univ., Cambridge. Horn Point Environmental Lab.

For primary bibliographic entry see Field 21.  
W79-03746

#### SEASONAL IONIC FLUCTUATIONS IN A PHRAGMITES COMMUNIS COMMUNITY,

Carleton Univ., Ottawa (Ontario). Dept. of Biology.

For primary bibliographic entry see Field 21.  
W79-03747

#### HABITAT SELECTION BY WATERFOWL OF ARGENTINE ISLA GRANDE,

Iowa State Univ., Ames. Dept. of Zoology and Entomology.

For primary bibliographic entry see Field 21.  
W79-03756

#### GEOGRAPHICAL VARIATION IN BRITISH SALT MARSH VEGETATION,

Cambridge Univ. (England). Botany School.

For primary bibliographic entry see Field 21.  
W79-03761

#### THE COMMUNITY STRUCTURE OF A TROPICAL MARINE LAGOON,

Dade County of Environmental Resources Management, Miami, FL.

R. F. Holm. Estuarine and Coastal Marine Science, Vol. 7, No. 4, p 329-345, October 1978. 9 fig, 4 tab, 44 ref.

Descriptors: \*Lagoons, \*Tropical regions, \*Florida, \*Biological communities, On-site investigations, Benthos, Benthic fauna, Phytoplankton, Tidal waters, Sediments, Sampling, Organic matter, Vegetation, Coasts, Shores, \*Florida Keys, \*Biscayne Bay(FL).

The structure of the benthic community in a near-shore tropical marine lagoon, in the upper Florida Keys, was examined in early spring and midsummer in 1973 and 1974. Eight environmental parameters (water depth, tidal range, current flow, water temperature, salinity, pH, sediment depth, and particle size) were monitored. The biota was compared along an intertidal-subtidal environmental gradient. The amount of vegetation present and the stability of the sediment modified the abundance and diversity of the benthic macrofauna. The results of this study were compared with those from other areas in the tropical Western Atlantic Ocean. The uniqueness of the lagunar environment made it possible to examine the changes in species abundance and diversity as a detritus-based food web graded into a phytoplankton based-food web. (Sims-ISWS)  
W79-03817

#### IMPACT OF NEARSHORE DEVELOPMENT ON OPEN COASTAL RESOURCES,

Southern California Coastal Water Research Project, El Segundo, CA.

For primary bibliographic entry see Field 5C.  
W79-03829

#### SYMPOSIUM: EXPERIMENTAL USE OF ALGAL CULTURES IN LIMNOLOGY; SAN DEFJORD, NORWAY, 26-28 OCTOBER 1976.

Internationale Vereinigung fuer Theoretische und Angewandte Limnologie, Stuttgart (Germany). F.R.).

For primary bibliographic entry see Field 5C.  
W79-03842

#### EFFECTS OF RIVER DISCHARGE ON THE COASTAL PHYTOPLANKTON CYCLE,

Norwegian Fisheries Directorate, Arendal, Stavanger Biological Station.

For primary bibliographic entry see Field 5C.  
W79-03873

GROWTH EXPERIMENTS WITH MARINE PHYTOPLANKTON ALGAE: THE ROLE OF 'WATER QUALITY' IN SPECIES SUCCESSION,

Oslo Univ. (Norway). Dept. of Marine Biology and Limnology.

For primary bibliographic entry see Field 5C.

W79-03888

#### ALGAL TESTS USED TO STUDY THE CHEMICAL FACTORS REGULATING THE GROWTH OF PHYTOPLANKTON ALGAE IN THE HELSINKI SEA AREA,

Helsinki City Engineer's Office (Finland). Water Conservation Lab.

For primary bibliographic entry see Field 5A.  
W79-03889

#### CHANGES IN SUCCESSION RATE IN A NATURAL PHYTOPLANKTON COMMUNITY FOLLOWING NUTRIENT ENRICHMENT,

Stockholm Univ. (Sweden). Inst. of Botany.

For primary bibliographic entry see Field 5C.  
W79-03894

#### A STEADY-STATE PHYTOPLANKTON MODEL OF CHESAPEAKE BAY,

Hydroscience, Inc., Westwood, NJ.

For primary bibliographic entry see Field 5C.  
W79-03899

#### POLYCHLORINATED BIPHENYL (PCB) UPTAKE BY MARINE PHYTOPLANKTON,

Stanford Univ., Pacific Grove, CA. Hopkins Marine Station.

For primary bibliographic entry see Field 5C.  
W79-03903

#### SAND AND GRAVEL OFFSHORE IN THE GREATER NEW YORK METROPOLITAN AREA: WHAT KIND AND HOW MUCH,

New York Sea Grant Inst., Albany.

D. Carlisle, and W. A. Wallace.

New York State Sea Grant Report Series No. NYSSGP-RS-78-13, (1978). 69 p, 14 fig, 5 tab, 70 ref, 12 map, 4 append.

Descriptors: \*Mining, \*Sands, \*Gravels, \*Environmental effects, Sediment transport, Sediment distribution, Dredging, \*Resource availability, Environmental assessment, New York Bight, Offshore mining.

The area offshore considered appropriate to satisfy the Greater New York Metropolitan Area's (G.N.Y.M.A.) demands for sand, gravel, and fill stretches from Atlantic City, New Jersey to the western border of Rhode Island. Data are presented and considered out to the 600-foot depth contour although currently, the most favorable conditions for mechanical dredging are deposits near shore in less than 30 feet of water. Data are presented at a level of detail sufficient for a regional economic analysis. Even if only nominal growth of the G.N.Y.M.A. by the year 2000 AD is considered, regional shortages of mineral aggregate will occur. Because of high transportation costs for moving existing on-shore supply to demand sites, consumers and producers of sand and gravel will be forced to look offshore. Review of existing surveys indicates that large quantities of clean sand exist in the offshore reaches. A summary of offshore resources is given. Several problems will

## Saline Water Conversion—Group 3A

emerge whenever mining occurs since the resource is located near shore. Conflicts will exist with local shellfishing interests. These conflicts may have either primary impact (direct disturbance of shellfish beds by dredging apparatus) or indirect impact (dumping of silt effluent which can cover and contaminate shellfish areas). (NOAA) W79-03963

**PCBS: THEIR ENVIRONMENTAL SIGNIFICANCE AND DISTRIBUTION IN RHODE ISLAND,**  
Rhode Island Univ., Narragansett. Coastal Resources Center.

For primary bibliographic entry see Field 5B.  
W79-03964

**WIND EROSION AND DEPOSITION ALONG A COASTAL SAND DUNE,**  
Delaware Univ., Newark. Coll. of Marine Studies.  
For primary bibliographic entry see Field 2J.  
W79-03965

**3. WATER SUPPLY AUGMENTATION AND CONSERVATION**

**3A. Saline Water Conversion**

**PRODUCTION AND CONSERVATION OF FRESH WATER,**  
Democritus Nuclear Research Center, Athens (Greece).

A. Delyannis, and E. Delyannis.  
Chemical Engineering In a Changing World, p. 313-324, 14 ref. (1977).

Descriptors: \*Desalination, \*Desalination processes, \*Water purification, Water treatment, Distillation, Electrodialysis, Reverse osmosis, Water conservation, Water management(Applied), Saline water intrusion, Water reuse, Irrigation water, Aquifers, Orange County, California, Colorado River, Yuma, Arizona, Groundwater recharge.

The progress made in desalination of brackish and sea water is reviewed. The desalination processes, distillation, electrodialysis, and reverse osmosis, are discussed with attention given to the impact of rising fuel prices on the cost of converted water. In some areas, Orange County, California, for example, water from a distillation plant is blended with reclaimed municipal sewage water, and injected into the ground to create a fresh water barrier which prevents sea water intrusion into the underground aquifer. Plans are underway for a desalination plant on the Colorado River at Yuma, Arizona, to treat irrigation drainage for use by Mexico. The plant, about 100 million gallons per day in size, may include both reverse osmosis and electrodialysis. (Davison-IPA) W79-03568

**NEW POLYMERIC MEMBRANES CONTAINING PHOSPHONATE ESTER GROUPS FOR WATER DESALINATION,**  
Gulf South Research Inst., New Orleans, LA.  
I. C. Cabasso.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 609. Price codes: A04 in paper copy, A01 in microfiche. Report January 1979, 62 p, 32 fig, 8 tab, 23 ref. OWRT No. 7545(1), 14-34-0001-7545.

Descriptors: \*Membranes, \*Reverse osmosis, Polymers, \*Desalination processes, Membrane processes, Asymmetric membranes, Cellulose acetate, Poly(vinylpyridine), Polyphosphate, Alloy polymers.

Three novel polymer membranes for water desalination by reverse osmosis were originated and characterized. Two of these, alloy membranes, were composed of cellulose acetate/poly(bromophenylene oxide phosphonate) and cellulose acetate/poly(4-vinyl pyridine). The alloy

membranes were cast as dense and asymmetric membranes. For the first alloy, CA/PPOBrP, two different structures have been identified for the asymmetric membrane: (1) the well known dense skin resting on an open-celled foam and (2) skin resting on a porous layer which displays a two-phase morphology. In the latter, dense spheres (0.1-1 micron) appear to grow out of a continuous polymer network. The second alloy, CA/PVP, has the same morphology as cellulose acetate when cast as an asymmetric membrane. Both membranes have high water permeabilities and high salt rejections. The third membrane was an asymmetric PPOBrP membrane. This polymer was cast into an asymmetric membrane which displays a sharp boundary between the skin and the porous structure resembling a composite membrane. The presence of PPOBrP polymer in the alloys increases the membrane operation range, with respect to pH (up to pH 11) and free chlorine (approximately 100 ppm). The membranes cast from the homopolymer seem to have even better durability, but should be characterized further. The three novel membranes were tested under hydraulic pressures up to 1200 psi, producing fluxes of 5-40 gfd and salt rejections greater than 90 percent. W79-03688

**DESIGN, CONSTRUCTION, AND FIELD EVALUATION TESTS OF AN 10,000 GPD SKID-MOUNTED ALUMINA-LIME-SODA PILOT PLANT,**

Midwest Research Inst., Kansas City, MO.  
A. D. Tippit, E. P. Shea, and J. W. Nebgen.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 755. Price codes: A05 in paper copy, A01 in microfiche. Technical Report (1978), 68 p, 7 fig, 22 tab, 3 append. OWRT (No 7546)(1), 14-34-0001-7546.

Descriptors: \*Silica, Heavy metals, \*Reverse osmosis, Brine, \*Desalination processes, \*Pilot plants, \*Desalination plants, New Mexico, Dissolved solids, Operations, Silica removal, Water recovery, \*Aluminum-lime-soda treatment.

A 10,000 gal/day skid-mounted alumina-lime-soda (ALS) pilot plant has been constructed and operated at the Office of Water Research and Technology Station at Roswell, New Mexico. The purpose of the pilot plant was to establish ALS operating parameters for removal of dissolved silica from reverse osmosis (RO) brines. Removal of silica foulant from RO brines permits further water recovery in additional RO stages. Results showed that dissolved silica could be routinely reduced to less than 12 mg/liter with the ALS process. Initial silica levels in the brine varied from 30 to 50 mg/liter. Optimum silica removal is accomplished in the pH range of 8.8 to 9.0. Common heavy metals were nearly quantitatively removed by the ALS process under optimum conditions for silica removal. Costs of the process range from \$0.30/1,000 gal. to \$0.35/1,000 gal. for waters initially containing 30 to 50 mg/liter of silica. W79-03765

**EXECUTIVE SUMMARY OF DESALTING PLANS AND PROGRESS, AN EVALUATION OF THE STATE-OF-THE-ART AND FUTURE RESEARCH AND DEVELOPMENT REQUIREMENTS,**

Fluor Engineers and Constructors, Inc., Irvine, CA.  
P. J. Schroeder, A. R. Khan, S. F. Mulford, A. S. Chan, and M. Gorry.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 786. Price codes: A03 in paper copy, A01 in microfiche. September 1978, 2 p, 11 fig, 20 tab. OWRT T-0024(No 7707)(1).

Descriptors: \*Desalination, \*Desalting technology, Technology transfer, Economic analysis, \*Cost analysis, \*Water demand, \*Water supply, Brackish water, \*Future planning(Projected), Forecasting, \*Reviews, \*Research priorities, Research and development.

The study revealed that there is a future need for desalting technology. The largest market today is overseas, but the future market in the U.S. is much larger than the overseas market (about six times as large). The U.S. need for desalinated water is expected to be over five billion gallons per day (BGD) by 1985 and over 29 BGD by the year 2000. A breakdown of these totals by the source of water demand is presented. Raw water supplies would be divided about as follows: 15.8 BGD from plain brackish waters (no contaminants or toxicants), 12.3 BGD from difficult brackish waters (industrial effluent wastewaters), and 1 BGD from seawater. The minimum expected desalinated water demand for the overseas market is 5.45 BGD, by the year 2000. The major portion of this market is in the Middle East. A breakdown of this market is provided. Saudi Arabia has the largest demand of any nation just to supply their minimum needs for domestic and industrial use. The effects of adding agricultural use and finally steam-electric use are illustrated. A breakdown of the desalting market in other countries is provided. (See also W79-03776) W79-03775

**DESLTING PLANS AND PROGRESS, AN EVALUATION OF THE STATE-OF-THE-ART AND FUTURE RESEARCH AND DEVELOPMENT REQUIREMENTS,**

Fluor Engineers and Constructors, Inc., Irvine, CA.  
P. J. Schroeder, A. R. Khan, and S. F. Mulford.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 785. Price codes: A08 in paper copy, A01 in microfiche. Final Report, January 1978, 140 p, 24 fig, 28 tab, 25 ref. OWRT T-0024 (No 7707)(1).

Descriptors: \*Reviews, \*Desalination, \*Technology transfer, Membranes, Distillation, Freezing, Economics, Evaluation, Cost projections, Market projection, Fixed costs, \*Research priorities, \*Future planning(Projected), Research and development.

An evaluation of the state-of-the-art of desalting technology (distillation, membranes, and freezing) was carried out. Potential desalting markets were estimated and present process economics were adjusted. Fully developed process economics were projected along with a development plan for each process. Cost and time requirements for each process development plan were estimated. A future market split among the three desalting processes is projected. A potentially large desalting market big enough to recover the future R and D investment in all three processes many times over is expected by the year 2000. The distillation process is still the best commercial and economical choice for seawater desalting and waste concentration. The freezing process can replace distillation at lower costs for desalting seawater and concentrating industrial effluents and waste waters if fully developed. However, this technology is presently undemonstrated commercially. Membrane processes have the greatest potential for cost reduction and are expected to dominate the desalting market for brackish and normal seawaters by the year 2000, and will have the largest market share. Seawater freeze desalting and seawater R.O. desalting water costs will be about a standoff when both processes are fully developed. (See also W79-03775) W79-03776

**APPARATUS FOR DESALINATING WATER,**  
R. E. Diggs.  
U.S. Patent No. 4,118,283, 19 p, 21 fig, 5 ref. Official Gazette of the United States Patent Office, Vol. 975, No. 1, p. 247, October 3, 1978.

Descriptors: \*Patents, \*Desalination, \*Desalination processes, \*Desalination apparatus, \*Solar radiation, Separation techniques, Vapor compression distillation, Condensation.

A method and apparatus are disclosed in which water is heated utilizing solar energy and then transferred to a vacuum chamber where it is vaporized and the water vapor separated from the solid residue in a continuous flow process. The

## Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

### Group 3A—Saline Water Conversion

water vapor is then transferred to a separate condensing chamber where it is condensed to form pure distilled water. Contaminated water flows across a grid and into a storage tank. The grid utilizes solar energy to heat that water to a predetermined temperature. A heat transfer structure which is dome-shaped and a preheater utilizing solar energy heats the water to a further predetermined temperature. An evaporator receives the heated water and exposes it to a vacuum condition so that the temperature of the water is above the saturation temperature. The water is thus vaporized, and solid contaminants are separated. The solids are deposited on a moving belt and are then moved into a solids removal system. Vapor transfer means removes the water vapor from the evaporator and transfers it to the heat transfer structure where it is condensed to form distilled water which is free of solid contaminants. (Sinha-OEIS) W79-03782

### ELECTROCHEMICAL WATER DESALINATION PROCESS,

H. J. R. Maget.

U.S. Patent No. 4,118,299, 11 p, 8 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 975, No. 1, p. 252, October 3, 1978.

Descriptors: \*Patents, \*Desalination, \*Desalination process, \*Water purification, Sea water, Saline water, Electrochemistry, Electro-osmosis, Hydrogen, Electrodes, Desalination apparatus.

A process and apparatus are provided for purifying salt-containing water such as sea water, brackish water and mineralized water. The water stream is mixed with hydrogen and then pumped into an electrochemical cell where hydrogen is ionized into protons. These protons migrating to the counter-electrode, under the influence of an applied potential, entrain liquid water. At the counter-electrode, protons recombine to form hydrogen while releasing liquid water. Hydrogen is recycled and participates into the process only as a vehicle for the transport of water. This process is particularly applicable to the purification of water with high salt content. The process is carried out with two electrodes (an anode and a cathode as counter-electrode) separated by a cation exchange membrane. The cation exchange membrane is an important element in the process, since through its physical and chemical properties, it will prevent salt-containing water to flow directly to the counter-electrode (without undergoing the change from hydrogen gas to protons), will also prevent dissolved salts to migrate to the counter-electrode and will also provide a physical barrier between anode and cathode thus preventing mixing of impure and pure water streams. W79-03783

### 3B. Water Yield Improvement

#### THE DEVELOPMENT AND PERPETUATION OF THE PERMANENT TAMARISK TYPE IN THE PHREATOPHYTE ZONE OF THE SOUTHWEST.

Rocky Mountain Forest and Range Experiment Station, Tempe, AZ.

J. S. Horton.

In: Importance, Preservation and Management of Riparian Habitat: A Symposium, July 9, 1977, Tucson, Arizona, USDA Forest Service General Technical Report RM-43, p. 124-127, 19 ref.

Descriptors: \*Riparian plants, \*Phreatophytes, \*Southwest U.S., \*Shrubs, Riparian land, Vegetation, Trees, Cottonwoods, Willow trees, Wetlands, Streams, Seeds, Competition, Drought resistance, \*Saltcedar.

Saltcedar (*Tamarix chinensis*) became naturalized and by the 1920's was a dominant shrub along the Southwestern rivers. Its aggressive characters allow it to be a permanent dominant in much of the phreatophyte vegetation in this region. Saltcedar produces seeds over a much longer period than do native species, it can become established after a summer recession flow when seeds of other species

are not present. Mature saltcedar is more drought-resistant than competing native shrubs and trees. (Stihler-Mass) W79-03718

#### AVIAN USE OF SALTCEDAR COMMUNITIES IN THE LOWER COLORADO RIVER VALLEY,

Arizona State Univ., Tempe, Dept. of Zoology, and Arizona State Univ., Tempe, Center for Environmental Studies.

B. W. Anderson, A. Higgins, and R. D. Ohmart. In: Importance, Preservation and Management of Riparian Habitat: A Symposium, July 9, 1977, Tucson, Arizona, USDA Forest Service General Technical Report RM-43, p. 128-136, 11 tab, 1 ref.

Descriptors: \*Riparian land, \*Birds, \*Census, \*Colorado River, Wetlands, Riparian plants, Trees, Cottonwoods, Willow trees, Mesquite, Non-game birds, Wildlife, Streams, Density, Saltcedar.

Bird densities and bird species diversities (BSD) is saltcedar (*Tamarix chinensis*) stands of the lower Colorado River Valley were determined on a seasonal basis from May 1974 through February 1977. Comparisons were made between six saltcedar structural types as well as on a community level with seven other vegetation types. A method of determining the relative value of the communities, as well as the saltcedar structural types, based on density, density with 10 percent doves, BDS, BDS with 10 percent doves, number of species, structural diversity, and size of census area is described. Results showed the saltcedar community supported fewer birds than native communities, although tall, dense stands were valuable for nesting doves and rarer bird species in riparian communities along the lower Colorado River. (Stihler-Mass) W79-03719

### 3C. Use Of Water Of Impaired Quality

#### ROOT GROWTH ALONG PLEXIGLAS SURFACES BY SUGARCANE UNDER DIFFERENT SOIL SALINITY CONDITIONS,

Texas Agricultural Experiment Station, Vernon, C. J. Gerard.

Agronomy Journal, Vol. 70, No. 4, p. 639-643, July-August, 1978, 7 fig, 1 tab, 12 ref.

Descriptors: \*Root development, \*Salinity, Moisture stress, Growth stages, Sugarcane, Plant growth, \*Saline soils, Crop response, Saline water.

Root growth of sugarcane (*Saccharum officinarum* L.) in soils irrigated with waters with electrical conductivities of 1.1, 5.0, and 8.0 mmhos/cm varied with stage of plant growth, time and salinity treatments. Root growth was greatest at soil depths of 20 to 60 cm in May, June, and July, a period of high growth rate and high evaporative conditions. During these months, average root intensities of sugarcane, irrigated with waters with salinities of 1.1, 5.0, and 8.0 mmhos/cm, were about 0.5, 1.0, and 1.5 mm/sq cm, respectively. Moisture stress induced by osmotic potentials of about -1.8 and -2.9 bar and high evaporative conditions stimulated root intensities but reduced top growth by 22 and 50%, respectively. These studies using root chambers have contributed to a better understanding of the interactive influences of stages of plant growth, salinity, and environment on root growth of sugarcane. (Skogerbøe-Colorado State) W79-03546

#### PLANNED WASTEWATER REUSE, A LITTLE-USED RESOURCE,

Municipal Environmental Research Lab., Cincinnati, OH.

F. M. Middleton. News of Environmental Research in Cincinnati, July 1977, 4 p, 1 fig, 1 tab, 7 ref.

Descriptors: \*Water reuse, \*Water utilization, \*Water conservation, Water shortage, Water supply, Public health, Economics, Cost analysis.

Social impact, Federal Water Pollution Control Act, Safe Drinking Water Act, Municipal wastes, Recycling, Artificial recharge, Waste water treatment, Injection, Percolation.

Although water reuse has been practiced for a number of years in many areas, planned water reuse has become mandatory through the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500) and the Safe Drinking Water Act of 1974. Activities related to water reuse by municipalities include long range plans for supplementing fresh supplies with renovated water, recharge to groundwater by injection or percolation of treated waste waters. In the water short areas of Dallas, Texas, and San Diego, California, it was found that providing 50% renovated water for these cities would cost 25% to 50% more than further development of natural supplies. This reuse will be necessary by early part of the next century, when more water supplies will be needed. A reuse potential check list is provided for communities to determine reuse feasibility by cost-effective analysis. Health effects of using renovated water and socio-economic considerations are discussed. It is concluded that Federal, state, and local authorities need to consider and begin programs incorporating reuse for the water resources of the nation. (Davis-IPN) W79-03569

MANAGEMENT OF SALINE WATER, California Univ., Davis, Dept. of Agricultural Economics. For primary bibliographic entry see Field 6B. W79-03774

### 3D. Conservation In Domestic and Municipal Use

#### URBAN RUNOFF CONTROL MASTER PLAN-NING,

American Society of Civil Engineers, Marblehead, MA. Urban Water Resources Research Program. For primary bibliographic entry see Field 6B. W79-03532

LEAST-COST DESIGN OF URBAN-DRAINAGE NETWORKS, Washington Univ., Seattle, Dept. of Civil Engineering. For primary bibliographic entry see Field 5D. W79-03533

ENGINEERING SOLUTIONS TO BAY AREA DROUGHT CONDITIONS, East Bay Municipal Utility District, Oakland, CA. For primary bibliographic entry see Field 4A. W79-03536

REGIONAL ECONOMETRIC FORECASTING MODELS: A TEST OF STRUCTURAL GENERALITY, DISAGGREGATION EFFECTS, AND POLICY ANALYSIS POTENTIALS, Wisconsin Univ.-Madison, Dept. of Urban and Regional Planning. For primary bibliographic entry see Field 6A. W79-03593

URBAN WATER RESOURCES POLICY ALTERNATIVES: A SOCIOLOGICAL ANALYSIS OF DIFFERENTIAL PERSPECTIVES, Purdue Univ., Lafayette, IN, Dept. of Sociology and Anthropology. For primary bibliographic entry see Field 6B. W79-03660

METHODOLOGIES OF EXAMINING POLLUTION FROM URBAN RUNOFF, Rutgers - The State Univ., New Brunswick, NJ, Dept. of Civil and Environmental Engineering. For primary bibliographic entry see Field 5B. W79-03689

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## Conservation In Agriculture—Group 3F

**AN ECONOMIC ANALYSIS OF PRICING RESIDENTIAL WATER SUPPLIES IN PUERTO RICO,**  
Puerto Rico Univ., Mayaguez. School of Engineering.  
For primary bibliographic entry see Field 6B.  
W79-03694

**3E. Conservation In Industry**

**WET/DRY COOLING SYSTEMS FOR FOSSIL-FUELED POWER PLANTS: WATER CONSERVATION AND PLUME ABATEMENT,**  
United Engineers and Constructors, Inc., Philadelphia, PA.  
For primary bibliographic entry see Field 5G.  
W79-03547

**POLLUTION ABATEMENT IN A COPPER WIRE MILL.**  
Environmental Protection Agency, Cincinnati, OH. Office of Technology Transfer.  
For primary bibliographic entry see Field 5D.  
W79-03572

**ANALYSIS OF DIFFERENT TYPES OF DRY-WET COOLING TOWERS,**  
Iowa Univ., Iowa City. Inst. of Hydraulic Research.  
For primary bibliographic entry see Field 8C.  
W79-03661

**OPTIMUM COMBINATIONS OF COOLING ALTERNATIVES FOR STEAM-ELECTRIC POWER PLANTS,**  
Iowa Univ., Iowa City. Inst. of Hydraulic Research.  
For primary bibliographic entry see Field 8C.  
W79-03662

**INDUSTRY VIEWS AND RESPONSIBILITIES IN OIL SPILL/WILDLIFE OPERATIONS,**  
American Petroleum Inst., Washington, DC.  
For primary bibliographic entry see Field 5G.  
W79-03834

**REUSE OF TREATED FRUIT PROCESSING WASTEWATER IN A CANNERY,**  
Snokot Growers, Yakima, WA.  
L. A. Esveld.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-289 805, Price codes: A07 in paper copy, A01 in microfiche. Final Report No. EPA-600/2-78-203, September 1978. 124 p, 29 fig, 28 tab, 10 ref, 1 append. S803280.

Descriptors: \*Water reuse, \*Waste water treatment, \*Industrial wastes, \*Canneries, Reclaimed water, Biological treatment, Water purification, Biochemical oxygen demand, Chemical oxygen demand, Chlorination, Effluents, Filtration, Investigations, Feasibility studies, Economics.

The technical and economic feasibility of reusing treated cannery processing effluent for supplementing or replacing a portion of the raw water supply are examined. The study spanned two processing seasons during which reclamation of the biologically treated effluent by filtration through mixed media pressure filters and disinfection with chlorine was investigated. Trial uses of the reclaimed water included: (1) initial product conveying; (2) equipment, floor and gutter wash; (3) direct contact container cooling; (4) boiler feed. Steam from the reclaimed waste water was used for equipment cleaning, exhausting, cooking and blanching on a trial basis, and no degradation of the product resulted from this use. Results from this study, compared with a 1967-1968 evaluation, revealed that the biological treatment system performances were equivalent except that the present endogenous respiration rate of the biological sludge was lower. Lower emissions rates for flow, chemical oxygen demand and biochemical oxygen

demands were shown during the earlier study due to more efficient in-plant controls. It is concluded that the biologically treated waste water can be reclaimed for reuse within the cannery except during periods of high suspended solids discharge from biological treatment. (Davison-IPA)  
W79-03966

**OVERVIEW OF THE FRESH PACK FOOD INDUSTRIES,**  
SRI International, Menlo Park, CA.  
For primary bibliographic entry see Field 5B.  
W79-03970

**OHIO RIVER BASIN ENERGY STUDY, ORBES PHASE I: INTERIM FINDINGS,**  
Illinois Univ., Urbana-Champaign.  
For primary bibliographic entry see Field 6G.  
W79-03971

**3F. Conservation In Agriculture**

**QUANTITATIVE ESTIMATION OF LIVING WHEAT-ROOT LENGTHS IN SOIL CORES,**  
Agricultural Research Service, Pendleton, OR. Columbia Plateau Conservation Research Center, K. J. Ward, B. Klepper, R. W. Rickman, and R. R. Allmaras.  
Agronomy Journal, Vol. 70, No. 4, p 673-677, July-August, 1978. 4 tab, 5 ref.

Descriptors: \*Root development, \*Wheat, Dicots, Monocots, Sampling, \*Soil cores.

A rapid, efficient method for separating living wheat (*Triticum aestivum* L.) roots from dead roots in field soil samples has been proposed. Combined techniques of separation, staining and length measurements were used to determine root density with an accuracy of plus or minus 9%. It was observed that most monocot roots stained more intensely than dicot roots, indicating that monocot-dicot root separation from the same root medium may facilitate studies of root competition. (Skogerboe-Colorado State)  
W79-03514

**INFLUENCE OF FERTILIZER AND RESIDUE MANAGEMENT ON GRASS SEED PRODUCTION,**  
Washington State Univ., Pullman. Dept. of Agronomy Soils, C. L. Canode, and A. G. Law.  
Agronomy Journal, Vol. 70, No. 4, p. 543-546, July-August, 1978. 3 tab, 8 ref.

Descriptors: \*Grasses, Wheatgrass, Fescues, Bromegrass, \*Fertilization, Burning, Air pollution.

The experiments were conducted on a silt loam soil (*Pachih Ultic Haplorthoxerolls*) as a split-plot within each grass species. Main plots were three levels of 18-10-10-7 fertilizer applied to supply N at 90, 112, and 135 kg/ha, with an associated increase in P, K, and S. Main plots were split for open burning and two levels of mechanical residue removal. Two crops of red fescue and four seed crops of smooth bromegrass and crested wheatgrass were evaluated. Average seed yields (kg/ha) for burning compared with mechanical straw removal were 636 vs. 495 for red fescue, 1,122 vs. 848 for smooth bromegrass, and 872 vs. 790 for crested wheatgrass.

Straw and stubble removal, compared with straw removal alone, increased seed yield of red fescue and smooth bromegrass, but decreased seed yield of crested wheatgrass. Interactions of fertilizer rates and residue management were not significant. The increase in seed production resulting from burning residue apparently was associated with control of downy bromegrass (*Bromus tectorum* L.) and increased vigor of autumn regrowth. (Skogerboe-Colorado State)  
W79-03530

**RELATIVE EVALUATION OF WATER STRESS INDICATORS FOR SOYBEANS,**

International Crops Research Inst., Hyderabad (India). Semi-Arid Tropics. M. V. K. Sivakumar, and R. H. Shaw. Agronomy Journal, Vol. 70, No. 4, p. 619-623, July-August, 1978. 7 fig, 1 tab, 23 ref, 1 equ.

Descriptors: \*Soybeans, Soil-water-plant relationships, \*Moisture stress, Moisture deficit, Growth rates, Plant growth, \*Soil water, \*Iowa, Indicators.

Field studies were conducted during 1976 on Idia silt loam (fine, silty, mixed (calcareous) mesic family of Typic Udothents) at the Western Iowa Experimental Farm, Castana, Iowa, to evaluate three plant measurements (vis., stomatal conductance, leaf-water potential, and leaf area) as water stress indicators for soybeans (*Glycine max* (L.) Merr.). Daily means of stomatal conductance and leaf-water potential measured several times during the growing season were closely related to changes in soil-water potential. 'Rate of leaf-area expansion' which is defined as the change in average leaf area (leaf area/number of leaves) per plant over a period of time, also showed a close correspondence with soil-water potential. Relative growth rates of soybeans showed a negative correlation with stomatal conductance, leaf-water potential, and rate of leaf-area expansion. The three plant measurements should prove useful in explaining water-deficit effects quantitatively under field conditions. (Skogerboe-Colorado State)  
W79-03521

**ACCUMULATION AND REDISTRIBUTION PATTERN OF DRY MATTER AND N IN TRITICALE AND WHEAT VARIETIES UNDER WATER STRESS CONDITION,**  
California Univ., Davis. Dept. of Land, Air, and Water Resources. P. Lal, G. G. Reddy, and M. S. Modi. Agronomy Journal, Vol. 70, No. 4, p. 623-626, July-August, 1978. 1 fig, 3 tab, 16 ref.

Descriptors: \*Cereal crops, \*Wheat, Moisture stress, Varieties, \*Nitrogen, Translocation, Economic efficiency, Moisture deficit, Crop production, Grains(Crops).

The objective of this study was to screen varieties of triticale (*Triticale hexaploidum* Lar.) relative to wheat (*Triticum aestivum* L.) for their high translocation ability and N utilization efficiency. A field experiment was conducted on silt loam soil (Typic Hapludoll) during 1973-74 at Pantnagar, India. Treatments consisting of five varieties each of triticale and wheat were arranged in a randomized block design with five replications. Plant samples were collected from a 0.125-sq m area for dry matter and N content studies in culm, lower leaf, flag leaf, spike chaff, and grain at successive stages. The loss of dry matter from different plant parts was assumed to be translocated to the grains. Both triticale and wheat cultivars differed greatly in their capacity to accumulate and redistribute dry matter and N. On an average, triticale cultivars removed larger amounts of N than the wheat. (Skogerboe-Colorado State)  
W79-03530

**INFLUENCE OF MANURE APPLICATION RATES AND CONTINUOUS CORN ON SOIL N,**  
Vermont Univ., Burlington. Dept. of Plant and Soil Science. F. R. Magdoff.

The manure-N experiments with continuous corn (*Zea mays* L.) were conducted on both a somewhat poorly drained Panton clay (Typic Ochraqual) and a well-drained Calais loam (Typic Fragiorthod). Manure rates of 0, 22, 44, and 66 metric tons/ha/year were combined in factorial arrangement with ammonium nitrate rates of 0, 112, and 224 kg N/ha/year. Comparison of calculated theoretical soil-N with experimentally determined levels after 5 years and the response of corn to fertilizer-N indicate that mineralization of manure organic-N, when applied to the Panton clay, was less than when applied to the Calais loam. Thus,

## Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

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manure-N was less available to the growing crop on the clay and accumulated in the soil at a greater rate than in the loam. The annual manure application rates required to maintain initial soil N levels in Panton clay and Calais loam under continuous corn production were calculated to be 40 to 52 tons/ha respectively. Two mineralization models were examined: Model 1 assumed only the first year manure mineralization rate above native soil organic matter decomposition rate; Model 2 assumed a 5-year mineralization decay series. Both were effective in predicting final soil-N levels. (Skogerboe-Colorado State) W79-03540

#### MEASURING SYMBIOTIC NITROGEN FIXATION IN RANGELAND PLOTS OF TRIFOLIUM SUBTERRANEUM L. AND BRONIUS MOLLIS L.

California Univ., Davis. Dept. of Agronomy and Range Science; and California Univ., Davis. Dept. of Vegetable Crops.

For primary bibliographic entry see Field 7B. W79-03552

#### EFFECTS OF SOIL WATER STRESS ON GROWTH AND NUTRIENT ACCUMULATION IN CORN

Kasetsart Univ., Bangkok (Thailand). Dept. of Soil Science.

V. Verasan. and R. E. Phillips. Agronomy Journal, Vol. 70, No. 4, p 613-618, July-August, 1978. 6 fig, 10 ref.

Descriptors: \*Moisture stress, \*Moisture deficit, \*Corn(Field). Plant growth, Nutrients, Plant physiology. Transpiration, \*Moisture tension.

The objective of this study was to more clearly delineate the effect of soil water stress on growth and accumulation of nutrient ions in corn. Corn was grown in the greenhouse in 20-liter pots containing soil from the Ap horizon of Maury silt loam (Typic Paleudalfs) under two soil moisture treatments, stressed and nonstressed. The relationship soil was potential and cumulative evapotranspiration with nutrient accumulation and dry matter production were more significant than the relationship of soil water potential with dry matter production and nutrient accumulation. Since water stress affects turbidity, photosynthesis, respiration, cell enlargement, and other physiological processes of the plant, it was concluded that cumulative transpiration is a better integrator of the effects of these processes on plant growth than is soil water potential. (Skogerboe-Colorado State) W79-03553

#### EVALUATION OF PROTEIN AND NUTRITIVE FIBER CONTENT OF CULTIVATED RUSSIAN THISTLE

New Mexico Agricultural Experiment Station, University Park.

D. A. Farmer, J. L. Fowler, and J. H. Hageman. Agronomy Journal, Vol. 68, p 691-692, July-August 1976. 2 tab, 18 ref. OWRT A-049-NMEX(1).

Descriptors: \*Forages, \*Nutrient requirements, \*Proteins, Fertilizer, Essential nutrients, Nitrogen compounds, Evaluation, Chemical analysis, \*Russian-thistle, Amino acids, Natural use, Efficiencies.

Nutritional parameters of Russian-thistle, *Salsola* sp., grown under controlled green house conditions, were measured. Various levels of nitrogen fertilizer were applied resulting in a protein content for the flowering plants of  $19.8 \pm 3.6\%$  for all levels of nitrogen application. Acid detergent lignin fiber values averaged  $34.5 \pm 5.3\%$ , acid detergent fiber values averaged  $6.4 \pm 1.6\%$ . No correlations were found between nitrogen application and total crude protein, acid detergent fiber, or acid detergent lignin. The amino acid composition of the total protein was nutritionally well balanced. These values are comparable to many commonly used forages. (Davison-IPA) W79-03587

#### INTERREGIONAL IMPACTS OF ALTERNATIVE WATER POLICIES FOR IRRIGATION IN THE WESTERN UNITED STATES: A QUANTITATIVE ASSESSMENT

Wisconsin Univ.-Madison. Dept. of Agricultural Economics.

For primary bibliographic entry see Field 6B. W79-03664

#### OUTLOOK FOR ENERGY AND IMPLICATIONS FOR IRRIGATED AGRICULTURE

Texas A and M Univ., College Station. Dept. of Agricultural Economics and Rural Sociology.

W. P. Patton, and R. D. Lacewell.

Available from the National Technical Information Service, Springfield, VA. 22161 as PB-290 588, Price codes: A04 in paper copy, A01 in microfiche. Texas Water Resources Institute, Texas A and M University, Technical Report No. 87, September 1977, 60 p, 7 fig, 11 tab, 57 ref. OWRT A-037-TEX(2), 14-34-0001-7091, 7092, 8046.

Descriptors: Energy, Water consumption, Water supply, Natural gas, Irrigated agriculture, Organic compounds, Pumping, \*Energy costs, Groundwater, \*Withdrawal, Texas Trans-Pecos, \*Texas High Plains.

Agriculture uses large quantities of energy to pump groundwater for irrigation. This means the cost of energy has important implications for the industry in terms of cost and profitability. Increases in the prices of energy sources such as natural gas, electricity, liquid petroleum gas and diesel can cause economic hardship for irrigators, particularly if those increases are unanticipated. The purpose of this paper is to briefly summarize important trends in the current domestic energy situation that could have significant impacts on the future cost and availability of energy, and to show what the implications of those trends are for irrigated agriculture. The primary focus is on trends in natural gas, since natural gas is the major fuel used for irrigation in the Great Plains states. W79-03667

#### COMBATING PHEASANT LOSSES IN THE COLUMBIA BASIN - WHERE DO WE GO FROM HERE

Washington State Univ., Pullman. Dept. of Agricultural Economics.

For primary bibliographic entry see Field 6B. W79-03686

#### PHEASANT ENHANCEMENT POTENTIALS IN IRRIGATED AGRICULTURE: A CASE STUDY OF THE COLUMBIA BASIN

Washington State Univ., Pullman. Dept. of Agricultural Economics.

For primary bibliographic entry see Field 6B. W79-03687

#### NOTE ON THE FERTILITY VALUE OF OXIDATION POND EFFLUENT FOR GROUND-NUT (ARACHIS HYPOGAEA L.)

Central Public Health Engineering Research Inst., Nagpur (India).

For primary bibliographic entry see Field 5D. W79-03696

#### ENVIRONMENTALIZING AGRICULTURAL PRODUCTION CONTROL POLICIES

Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Economics.

For primary bibliographic entry see Field 5G. W79-03767

#### METHOD AND MEANS FOR IRRIGATING SOIL AND GROWING PLANTS HAVING VARYING WATER REQUIREMENTS

W. Skafie.

U.S. Patent No. 4,117,685, 4 p, 7 fig, 8 ref. Official Gazette of the United States Patent Office, Vol. 975, No. 1, p 50, October 3, 1978.

Descriptors: \*Patents, \*Irrigation, \*Subsurface irrigation, Soil-water-plant relationships, Irrigation practices, Irrigation efficiency, Water requirements, Moisture uptake.

A material having high water absorption and retention capacity is placed in a water impermeable trench beneath a top coversoil and water is supplied to the material for being transmitted by capillary action to the top soil. The material may be vitera. The roots of plants having varying water requirements will grow to whatever depth is appropriate for their needs. (Sinha-OEIS) W79-03780

#### WATER COLLECTION INDICATOR DEVICE

R. F. Cahill.

U.S. Patent No. 4,119,056, 8 fig, 7 ref. Official Gazette of the United States Patent Office, Vol. 975, no 2, p 515, October 10, 1979.

Descriptors: \*Patents, \*Measurement, \*Irrigation, Irrigation practices, Irrigation efficiency, Water levels, Water requirements, Water supply, Equipment.

Some of the advantages of this invention are that the amount of irrigation water to be supplied to crops can be preselected, the actual water supplied to the crops can be measured, a signal is produced which is visible over long distances and from any direction. Rainfall can also be measured so that total irrigation watering can be limited to a desired amount. A water collection indicator device includes a cup-like collector for collecting water, a signal member telescoping relative to the collector, a bias spring forcing the signal member away from the collector, and an actuator pivotally supported in the collecting including an arm engaging the signal member to prevent movement of the signal member away from the collector and a float movable with rising water level in the collector to pivot the actuator and disengage the arm from the signal member whereby the bias spring will move the signal member away from the collector to produce a visual signal indicating collection of a predetermined amount of water. (Sinha - OEIS) W79-03785

#### MOBILE AGRICULTURAL IRRIGATION APPARATUS

H. Tidwell.

U.S. Patent No. 4,119,272, 4 p, 3 fig, 6 ref. Official Gazette of the United States Patent Office, Vol. 975, no 2, p 589, October 10, 1978.

Descriptors: \*Patents, \*Irrigation, \*Application equipment, Irrigation practices, Irrigation efficiency, Water conveyance, Self-propelled equipment, Irrigation boom.

A self-contained and self-propelled irrigation apparatus for row crops embodies a comparatively short closed end apertured irrigation boom which receives water through the tubular shaft of a hose reel mounted on the boom. The boom and hose reel are carried by a wheeled support which includes widely spaced traction wheels and a center stabilizing wheel. A platform on the boom mounts an engine and drive trains for the traction wheels and hose reel. (Sinha - OEIS) W79-03786

#### FLUID SPRAY HEAD AND METHOD ADAPTED TO SPRAY SPECIFIC PATTERN

Toro Co., San Marcos, CA. (Assignee).

E. J. Hunter.

U.S. Patent No. 4,119,275, 8 p, 7 fig, 5 ref. Official Gazette of the United States Patent Office, Vol. 975, No. 2, p. 590, October 10, 1978.

Descriptors: \*Patents, \*Irrigation, \*Sprinkler irrigation, Irrigation practices, Irrigation efficiency, Sprays, Application equipment, Flow control.

An improved fluid spray head for sprinkler apparatus is disclosed adjustable both as to the flow rate of fluid to the discharge orifices and the precipitation rate over the ground area sprayed, and par-

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icularly adapted to spray a specifically shaped non-circular area. The spray head has circumferentially-spaced discharge orifices having cross-sectional areas equally proportional to the square of the distance that their respective spray streams are desired to travel whereby the perimeter of the ground area sprayed defines the preselected shape and receives a substantially uniform coverage of fluid. The spray head includes an inner tubular member which telescopes within an outer tubular member to provide the simultaneous adjustment of the size of the discharge orifices. The inner tubular member is made radially thinner so as to be more pressure expandable under fluid pressure to thereby tighten the fluid seal between the inner tubular member and the outer tubular member. Methods for constructing and operating a fluid spray head adapted to spraying a specific pattern or shaped area are also disclosed. (Sinha-OEIS) W79-03787

## CENTER PIVOT IRRIGATION APPARATUS, L. D. Holtzen. U.S. Patent No 4,120,454, 9 p, 7 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 975, No 3, p 994, October 17, 1978.

Descriptors: \*Patents, \*Irrigation, \*Sprinkler irrigation, Irrigation practices, Irrigation efficiency, Water control, Application equipment, Electrical equipment, Self-propelled equipment, Center pivot irrigation system.

An electrically controlled water powered reversible center pivot irrigation apparatus is disclosed. The apparatus includes water-carrying conduits flexibly connected to each other and supported at intervals by self-propelled supports. Each of the self-propelled supports includes a water powered sprinkler which turns a drive shaft for propulsion of the support. An electrically controlled transmission designates the direction in which the support travels and mechanical linkages, operable in either direction of movement of the apparatus, control the flow of water from the conduits to the sprinklers depending upon the relative position between adjacent conduits. (Sinha-OEIS) W79-03794

## THE EFFECT OF STABILIZED, HYDROPHOBIC AGGREGATE LAYER PROPERTIES ON SOIL WATER REGIME AND SEEDLING EMERGENCE, Hebrew Univ., Rehovoth (Israel). Faculty of Agriculture.

For primary bibliographic entry see Field 2G. W79-03803

## MEASUREMENT OF FURROW INFILTRATION RATES MADE EASY, Science and Education Administration, Prosser, WA. Federal Research.

For primary bibliographic entry see Field 7B. W79-03807

## RADIATION AND ENERGY BALANCE OF A TRICKLE-IRRIGATED LEMON GROVE, Arizona Water Resources Research Center, Tucson.

J. Ben-Asher, and T. W. Sammis. Agronomy Journal, Vol. 70, No. 4, p 568-572, July-August, 1978. 4 fig, 2 tab, 7 ref. OWRT B-035-ARIZ(8) and B-045-ARIZ(9).

Descriptors: Water conservation, Irrigation, \*Irrigation systems, \*Evapotranspiration, \*Lemons, Albedo, \*Radiation, \*Energy budget, Trickle irrigation.

This study was conducted to evaluate the water saving potential and evapotranspiration from a trickle irrigated lemon grove (*Citrus limon* L. 'Lisbon'). Detailed measurements of global, reflected, and net radiation and its dissipation above the plant, the unshaded sandy soil, and the area as a whole were made in the spring and summer of 1975. Two sources of radiant energy were observed: net radiation which accounted for 70% of

the energy utilized in evapotranspiration and reflected radiation from the unshaded soil accounting for 30%. Experimentally the net radiation and the evapotranspiration from the area as a whole decreased and vice versa. On the other hand, evapotranspiration and its ratio to evaporation from a class A pan were smaller than any previously reported values. Therefore, it is suggested that for these two periods the contribution of energy from the dry area to the wet did not reflect a specific disadvantage for trickle irrigation. (Skogerboe-Colorado State) W79-03828

## NATIONAL CONFERENCE ON MANAGEMENT OF NITROGEN IN IRRIGATED AGRICULTURE.

For primary bibliographic entry see Field 5G. W79-03941

## THE INDISPENSABLE ROLE OF NITROGEN IN AGRICULTURAL PRODUCTION, Nebraska Univ., Lincoln. Dept. of Agronomy. R. A. Olson.

In: National Conference on Management of Nitrogen in Irrigated Agriculture, p 1-31, 1978. 10 fig, 2 tab, 35 ref.

Descriptors: \*Nitrogen, \*Fertilizers, Nutrients, \*Crop production, Crop response, Pollutants.

The indispensable role of nitrogen in food and fiber production for the world's people cannot be disputed. There is no substitute for nitrogen in its essential roles as a component of the chlorophyll and protein constituents of crop plants. The quantity required for obtaining an economic yield of most crops exceeds that of all other soil-derived essential nutrients. The advent of relatively cheap fertilizer nitrogen in the 1950's caused radical increases in yields obtainable with most crops in the developed countries and provided the spark that ignited the Green Revolution in many of the Less Developed Countries in the 1960's as well. Its preeminence in the food production chain notwithstanding, nitrogen has been subjected recently to more critical surveillance than any other element in agriculture by reason of energy expended in its conversion into fertilizers, its monetary cost to the farmer, and its potential role as environmental pollutant. The economic and environmental problems can be minimized, however, by matching rate and timing of applied nitrogen with the amount likely to be provided the soil during the growing season and with the water regime afforded. The agricultural sector must achieve this matching objective promptly if it is not to be condemned by the rest of society in the long term. (See also W79-03941) (Skogerboe-Colorado State) W79-03946

Harvested agronomic and horticultural plants, excluding rice, are grown under irrigation on over 16 million hectares of land in 33 states. The paper presents results of a survey of published and recent unpublished information on removal of soil and fertilizer nitrogen from irrigated land in the harvested portion of crops. The amount of nitrogen removed varied considerably among different plant species and within the same species when grown under widely different management and environmental conditions. The amount of fertilizer nitrogen apparently removed during harvest was greater for hay, silage, and pasture crops and least for certain vegetables, fruits, and nuts. The amounts of nitrogen removed by grain crops generally was within the average range for all crops, 40 to 60% of the nitrogen applied. Fertilizer efficiency is discussed from three main viewpoints: in terms of (1) the amount of applied nitrogen found in the plant, (2) the yield of harvested plant parts in relation to amount of fertilizer nitrogen applied, and (3) the cash value of marketable crop in relation to nitrogen cost. Examples are given, using data for coastal bermudagrass and wheat, of fertilizer efficiency as calculated on the basis of these viewpoints. Methodological problems of collecting data and problems of data interpretation are discussed in relation to the several concepts of fertilizer efficiency, and emphasis is placed on the need to recognize the role of all soil, and crop management factors in determining the efficiency by which plants use nitrogen. (See also W79-03941) (Skogerboe-Colorado State) W79-03946

## VOLATILE LOSSES OF NITROGEN FROM SOIL.

California Univ., Davis. Dept. of Land, Air and Water Resources.

D. E. Rolston. In: National Conference on Management of Nitrogen in Irrigated Agriculture, p 169-193, 1978. 4 fig, 18 ref.

Descriptors: Denitrification, \*Volatility, \*Nitrogen, Fertilization, \*Soils.

Nitrogen may be lost from soil in the gaseous form by two major mechanisms, ammonia volatilization and denitrification. Ammonia gas may be lost to the atmosphere whenever ammonium compounds are applied to the soil surface. The greatest ammonia losses occur from calcareous soils at high soil pH. Fertilizers such as urea and ammonium sulfate result in greater ammonia loss than that from ammonium nitrate when applied to a moist soil surface. More than 50% of the applied fertilizer may be lost by ammonia volatilization if precautions are not taken. The best solution for minimizing ammonia loss is to incorporate or place ammonium compounds approximately 10 cm below relatively dry surface soil. The volatile products of denitrification, nitrous oxide and nitrogen gas, may be lost from the soil whenever the soil becomes wet enough that oxygen becomes depleted and sufficient carbon is available from organic materials to support microbial activity. Denitrification occurs significantly only over a very narrow soil-water content range near saturation and in those portions of the soil profile with fairly high organic material. Consequently, denitrification will generally only occur in the surface 60 cm of most soils of arid regions unless perched water tables exist at a buried surface horizon. Management practices to either minimize or maximize denitrification should be directed at controlling nitrate position and water content in the surface soil. (See also W79-03941) (Skogerboe-Colorado State) W79-03947

LEACHING OF NITRATE FROM SOILS, Washington State Univ., Pullman. Dept. of Agronomy and Soils.

For primary bibliographic entry see Field 5G. W79-03948

EFFECT OF WATER MANAGEMENT ON NITRATE LEACHING, California Univ., Riverside. Dept. of Soil and En-

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### Group 3F—Conservation In Agriculture

vironmental Sciences.

J. Letey, J. W. Biggar, L. H. Stolzy, and R. S. Ayers.

In: National Conference on Management of Nitrogen in Irrigated Agriculture, p 231-249, 1978. 4 fig. 3 tab.

Descriptors: \*Nitrates, \*Leaching, Water pollution, \*Water management(Applied), \*Nitrogen, Fertilization, Effluents, Correlation analysis.

Nitrates which are leached (transported below the root zone) represent a resource loss and a potential contribution to water pollution. The amounts of leached nitrates for a given time period were determined at various commercial farming sites in California and in a carefully controlled experimental plot receiving various water and fertilizer application treatments. Some of the agricultural sites had tile drainage systems and others had 'free drainage' to the groundwater. Linear regression analyses were conducted on the data. Similar results were observed for the tile and free drainage systems. The highest correlation coefficient was achieved for the amount of leached nitrates versus the product of the drainage volume and fertilizer nitrogen application. The next highest correlation coefficient was for amount leached versus drainage volume followed by amount leached versus fertilizer nitrogen application. In most cases there was no significant correlation between nitrate concentration in the water below the root zone and drainage volume or fertilizer nitrogen application. A significant linear relationship between amount of leached nitrate and drainage volume was also obtained at the experimental plot. (See also W79-03941) (Skogerboe-Colorado State)

W79-03949

#### MONITORING WATER FOR NITROGEN LOSSES FROM CROPLANDS,

California Univ., Davis. Dept. of Land, Air and Water Resources.

For primary bibliographic entry see Field 5G. W79-03950

#### USE OF MATHEMATICAL RELATIONSHIPS TO DESCRIBE THE BEHAVIOR OF NITROGEN IN THE CROP ROOT ZONE,

Florida Univ., Gainesville. Dept. of Soil Science. J. M. Davidson, and P. S. C. Rao.

In: National Conference on Management of Nitrogen in Irrigated Agriculture, p 291-319, 1978. 7 fig. 3 tab. 27 ref.

Descriptors: \*Nitrogen, Denitrification, \*Root zone, Soil water movement, \*Mathematical studies.

A procedure to estimate the movement of water-soluble nitrogen species ( $\text{NO}_3$  and  $\text{NH}_4$ ) was developed by assuming that (1) the soil-water residing in all pore-sequences participates in the transport process, and the (2) the soil-water initially present in the soil profile was completely displaced ahead of the water entering at the soil surface. Field-capacity and initial soil-water content distribution in addition to total water inputs were necessary parameters to estimate solute transport in the root zone. First-order kinetics were assumed to describe the nitrogen transformations (mineralization, immobilization, nitrification, and denitrification). These transformation processes were considered to occur under ideal conditions. Plant uptake of water and nitrogen (nitrate and ammonium) was estimated, respectively, from potential evapotranspiration and nitrogen uptake rate under ideal environmental conditions for a given crop. Actual plant uptake of water and nitrogen was dependent upon the available soil water and total mineral nitrogen within the crop root zone. These mathematical relationships could be solved using a programmable desk-top calculator; however, a larger computer was needed when more complex submodels were employed to describe soil-water uptake. The proposed mathematical relationships can provide field managers and regulatory personnel with an integrated description of the behavior of nitrogen in the root zone during a crop growing

season. (See also W79-03941) (Skogerboe-Colorado State)

W79-03952

#### DIAGNOSTIC TECHNIQUES USED TO IDENTIFY OPTIMUM LEVELS OF NITROGEN FERTILIZATION FOR IRRIGATED CROPS,

Oregon State Univ., Corvallis. Dept. of Soil Science.

T. L. Jackson.

In: National Conference on Management of Nitrogen in Irrigated Agriculture, p 321-332, 1978. 27 ref.

Descriptors: \*Nitrogen, \*Fertilization, Irrigation water, Nitrates, Analytical techniques.

The nitrogen available for plant growth comes primarily from (1) the nitrogen released from soil humus and crop residues, (2) nitrogen added as commercial fertilizers and (3) residual inorganic nitrogen from previous growing seasons or previous crops. Irrigation insures adequate moisture and relatively uniform yields from year to year. Irrigation also makes feasible the application of fertilizer nitrogen during the growth of the crop and this provides the opportunity to use soil and plant analysis early in the crop season to assess nitrogen needs. Examples of the use of diagnostic techniques for estimating the fertilizer nitrogen required to supplement residual nitrogen levels and the capacity of the soil to release nitrogen are presented. (See also W79-03941) (Skogerboe-Colorado State)

W79-03953

#### ECONOMIC CONCEPTS AND POLICIES RELATED TO CONTROLLING NON-POINT SOURCE POLLUTION STEMMING FROM AGRICULTURE,

Washington State Univ., Pullman. Dept. of Agricultural Economics.

For primary bibliographic entry see Field 5G. W79-03954

#### ECONOMIC IMPACTS OF CONTROLLING NITROGEN CONCENTRATION AND OTHER WATER QUALITY DETERMINANTS IN THE YAKIMA RIVER BASIN,

North Dakota State Univ., Fargo. Dept. of Agricultural Economics.

For primary bibliographic entry see Field 5G. W79-03956

#### NITROGEN BALANCES FOR THE SANTA MARIA VALLEY,

California Univ., Riverside. Dept. of Soil and Environmental Sciences.

For primary bibliographic entry see Field 5G. W79-03957

#### AN ECONOMIC METHODOLOGY FOR EVALUATING 'BEST MANAGEMENT PRACTICES' IN THE SAN JOAQUIN VALLEY OF CALIFORNIA,

Economics, Statistics, and Cooperatives Service, Washington, DC.

For primary bibliographic entry see Field 5G. W79-03958

#### OVERVIEW OF NITROGEN IN IRRIGATED AGRICULTURE,

California Univ., Davis. Cooperative Extension.

For primary bibliographic entry see Field 5G. W79-03959

## 4. WATER QUANTITY MANAGEMENT AND CONTROL

### 4A. Control Of Water On The Surface

#### INSTREAM FLOW-APPLICABILITY OF EXISTING METHODOLOGIES FOR ALASKAN WATERS,

Woodward-Clyde Consultants, Anchorage, AL.

A. G. Ott, and K. E. Tarbox.

Final Report, Alaska Department of Fish and Game and Department of Natural Resources, August 1977. 70 p, 9 fig, 5 tab, 22 ref, 1 append.

Descriptors: \*Alaska, \*Streamflow, \*Rivers, \*Methodology, \*Hydrology, \*Water demand, Legislation, Statutes, Regulation, Classification, Reviews, Discharge(Water), Fish, Biological communities, Seasonal, Aerial photography, Meandering streams, Braided streams, Straight streams.

To facilitate planning for an expected increase in water requirements in Alaska due to oil and gas development, transfer of public lands to private ownership, and hydroelectric projects, applicability of 11 methodologies for instream flow requirements for maintaining fish and wildlife was evaluated. It is concluded that, due to extreme seasonal flow variability of the streams, diversity of stream types, absence of a hydrological data base, and lack of sophisticated field studies, no single method reviewed is applicable. Recommendations: (1) In the absence of detailed field investigations, the Montana Method may be applied to mountainous, split, and single-channel meandering streams, provided that limited field testing in Alaska verifies the basic relationships of the method. (2) For streams with immediate water allocation problems, field investigations using methods of the U.S. Fish and Wildlife Service Instream Flow Group should be initiated, and these methods should be refined for ultimate use on other Alaskan stream systems. (3) For braided, split-channel, and incised streams, field investigations should be started to define hydrological and biological relationships relative to altered flow patterns. Other methods reviewed: U.S. Fish and Wildlife (Billings, Montana); Oregon; Washington; U.S. Forest Service; Idaho Fish and Game; Indicator Species; Trout Cover Rating System; Habitat Quality Rating; and Waters. (Lynch-Wisconsin)

W79-03517

#### OPTIMAL SEQUENCING FOR A MULTIPURPOSE WATER SUPPLY SYSTEM,

Banyaszati Kutato Intezet, Budapest (Hungary).

I. Bogardi, F. Szidarovszky, and L. Duckstein.

Advances in Water Resources, Vol. 1, No. 5, p. 275-284, 1978. 10 fig, 4 tab, 20 ref.

Descriptors: \*Water resources development, \*Water supply, \*Multiple-purpose, \*Optimization, \*Economic efficiency, \*Sequencing, \*Cost minimization, Dynamic programming, Water requirements, Water shortage, Water allocation(Policy), Equations, Mathematical models, Systems analysis, Economic losses, Game-theoretical method, Non-linear programming, Planning.

The optimal sequencing of a multipurpose water supply system in the Hajduhatsag region of Hungary is determined using dynamic programming (DP). The goal function minimizes the present value of capital costs, operating costs, and economic losses due to water shortages. Future water requirements are considered to be random variables because of natural and forecasting uncertainties. The nonlinear optimization problem at each stage is equivalent to a readily solved game theoretical problem, the solution of which is straightforward. Sensitivity analysis performed with respect to economic losses, water requirements and discount rate has shown that optimal development and sequencing depend largely on the economic losses and the discount rate. (Bell-Cornell)

W79-03518

## WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

### Control Of Water On The Surface—Group 4A

**WATER RESOURCES CONTROL THROUGH SYSTEMS ANALYSIS,**  
International Inst. for Applied Systems Analysis,  
Laxenburg (Austria).  
D. R. Maidment.  
Water Supply and Management, Vol. 2, No. 3, p.  
243-251, 1978. 34 ref.

Descriptors: \*Water resources, \*Control, \*Systems analysis, \*Short-term operation, \*Long-term operation, Water allocation(Policy), Floods, Simulation analysis, Data collections, Optimization, Reservoir operation, River basins, Operating policy.

Systems analysis can be applied to short-term and long-term operation and control of water resources systems. Short-term operation over hours or days is concerned with transient phenomena such as floods, and requires operating policies which are being continuously updated as new measured information is received. Long-term operation over months or years is concerned with allocation of water among competing users, taking account of possible shortages of water supply due to droughts. Systems analysis application procedures which develop appropriate operating policies are described together with some experiences gained in the implementation of these procedures in various countries. Topics requiring further applied systems analysis are identified. (Bell-Cornell)  
W79-03519

**ALLOCATIONAL INEFFICIENCY OF BENEFIT/COST APPLIED TO WATER AND SEWERAGE SUPPLY: INTERACTIONS BETWEEN TIME-SERIES AND CROSS-SECTIONAL MODELS,**  
Pennsylvania State Univ., University Park. Dept. of Economics.

For primary bibliographic entry see Field 6B.  
W79-03520

**SIMULATION PROCEDURES FOR BOX-JENKINS MODELS,**  
University of Western Ontario, London.

For primary bibliographic entry see Field 2E.  
W79-03523

**RECENT DEVELOPMENTS IN THE MCCLELLAN-KERR ARKANSAS RIVER NAVIGATION SYSTEM AREA.**

Army Engineer Div., Southwestern Dallas, TX. Available from the National Technical Information Service, Springfield, VA 22161 as ADA-054 146, Price codes: A07 in paper copy, A01 in microfiche. IWR Research Report 77-R1, U.S. Army Engineer Institute for Water Resources, Fort Belvoir, Virginia, April 1977. 130 p, 12 fig, 25 tab, 1 plate, 47 ref.

Descriptors: \*River systems, \*Navigation, \*Data collections, \*Demographic factors, \*Economic development, \*Public sectors, \*Projects, Agriculture, Recreation, Industries, Transportation, Harbors, Population, Employment, Natural resources, Public policy.

This report brings together data and a description of demographic, economic development, and public sectors which identify current conditions in the area of the McClellan-Kerr Arkansas River Navigation System for the years 1971-1974. Discussed are natural resources, transportation and port development, industrial development, agricultural development, recreation developments, public policy response, opportunities and problems, and population, employment and income. The project includes the navigation channel extending from the Mississippi River to Catoosa, Oklahoma and the three major upstream lakes which were originally authorized in the navigation plan, costing over \$1.2 billion. The primary impact area described herein includes 28 counties bordering the waterway and the three upstream lakes. (Bell-Cornell)  
W79-03526

**CLIMATE, CLIMATIC CHANGE, AND WATER SUPPLY**  
National Research Council, Washington, DC.  
For primary bibliographic entry see Field 2B.  
W79-03527

**WATER-RESOURCE SYSTEMS PLANNING,**  
Geological Survey, Reston, VA.  
For primary bibliographic entry see Field 6B.  
W79-03528

**URBAN RUNOFF CONTROL MASTER PLANNING,**

American Society of Civil Engineers, Marblehead, MA. Urban Water Resources Research Program. For primary bibliographic entry see Field 6B.  
W79-03523

**LAND USE ALLOCATION MODEL FOR FLOOD CONTROL,**

Illinois Univ. at Urbana-Champaign. Inst. for Environmental Studies.  
L. D. Hopkins, E. D. Brill, Jr., J. C. Liebman, and H. G. Wenzel, Jr.  
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 104, No WR1, p 93-104, November 1978. 2 fig, 14 equ, 25 ref.

Descriptors: \*Flood control, \*Land use, \*Non-structural alternatives, \*Optimization, Water resources, Runoff, Dynamic programming, Hydrology, Flood damage, Upstream, Downstream, Computer models, Watersheds(Basins), Urban development, Urban planning, Triangle routing procedure, Economic rent maximization, Equations, Systems analysis.

A dynamic programming model is developed that finds the optimal allocation of land uses to maximize economic rent to land net of flood damage. The model specifically considers the impact of upstream development on downstream flood levels and the impact of flood-plain development on the amount of damage for given flood levels. An efficient, but elementary, routing procedure is developed to meet the requirements of the dynamic programming model. The model is demonstrated on realistic data for a watershed with 42 subbasins and eight land-use categories. This test problem is solved in several trials, each requiring about 30 seconds of computing time. The solutions appear to be stable despite the artificial discretization of flood flows. The model is useful for exploring the relationships among land use decisions and flood damages and for identifying target land use patterns for particular watersheds. (Bell-Cornell)  
W79-03534

**ENGINEERING SOLUTIONS TO BAY AREA DROUGHT CONDITIONS,**

East Bay Municipal Utility District, Oakland, CA. D. G. Larkin.  
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 104, No WR1, p 235-251, November 1978. 7 fig.

Descriptors: \*Droughts, \*Water deprivation, \*Water conservation, Water quality, Standards, Pipe joints, Emergencies, Interconnected systems, Water supply, California, \*San Francisco Bay Area, Water agencies, Water plans, Agreements.

California underwent a 2 year drought from 1976 to 1978 which had a serious effect on all water supplies in the State. In the San Francisco Bay Area, several local water agencies, in conjunction with Federal and State agencies, developed complex multi-party agreements of mutual aid to alleviate the drought emergency. In record time of only a month from conceptual plan to startup, drought-relief water was provided to the local agencies in need. Three formal agreements among the several parties were developed with minimum red tape because the engineering staffs of the agencies involved realized the urgency of the situation. This attitude prevailed in the planning and design, as

well as in the construction contract. The facilities constructed provided both supplemental water and high quality dilution water, and the effects of the drought were minimized. (Bell-Cornell)  
W79-03536

**POWER DEVELOPMENT AND WATER ALLOCATION IN OHIO RIVER BASIN,**

Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.  
R. W. Fuessle, R. M. Lyon, E. D. Brill, Jr., G. E. Stout, and K. E. Wojnarowski.  
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 104, No WR1, p 193-209, November 1978. 3 fig, 8 tab, 35 ref.

Descriptors: \*Cooling towers, \*Planning, \*Ohio River, \*Water supply, \*Thermoelectric power generation, \*Water consumption, Water utilization, Irrigation, Municipal water, Industrial water, Plant siting, River basins, \*Water allocation(Policy).

Widespread adoption of evaporative cooling towers will significantly increase water consumption by powerplants over the coming decades. The analysis presented includes consideration of allocation issues associated with other growing competitive uses: (1) municipal; (2) industrial; (3) irrigation; and (4) in-stream uses. Given hypothetical plant siting strategies suggested by the initial work of the Ohio River Basin Energy Study, consumption will represent high percentages of flows in the tributary basins of the lower Ohio River Basin, especially during 7-day, 10-year low-flow conditions. Consumption levels are shown for tributary river basins in Illinois, Indiana, Ohio, and Kentucky. Alternatives to high levels of consumption are suggested. In addition to presenting an analysis of water allocation in the Ohio Basin, this paper suggests a useful framework for analyzing water allocation in other regions. (Bell-Cornell)  
W79-03537

**DELAWARE RIVER BASIN WATER RESOURCES MANAGEMENT,**

Delaware River Basin Commission, Trenton, NJ.  
For primary bibliographic entry see Field 6B.  
W79-03538

**INFORMATION REQUIREMENTS FOR IMPROVING HYDROPOWER,**

California Univ., Los Angeles. Dept. of Engineering Systems.  
For primary bibliographic entry see Field 8C.  
W79-03542

**ON THE THEORY AND MODELING OF DYNAMIC PROGRAMMING WITH APPLICATIONS IN RESERVOIR OPERATION,**

Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.

M. Sniegovich.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 586. Price codes: A06 in paper copy, A01 in microfiche. Ph.D. Dissertation, December, 1976. 112 p, 1 tab, 30 ref, 2 append (University of Arizona Reports on Natural Resource Systems No 27). OWRT B-043-ARIZ(23). 14-31-0001-5056.

Descriptors: \*Dynamic programming, \*Algorithms, \*Model studies, \*Reservoir operations, \*Optimization, \*Decision making, \*Reservoir stages, Time series analysis, Computer models, Computer programs.

The validity of the principle of optimality and the dynamic programming algorithm in the context of discrete time and state multistage decision processes is discussed. The multistage decision model developed for the purpose of the investigation is of a general structure, especially as far as the reward function is concerned. The validity of the dynamic programming algorithm as a solution method is investigated and results are obtained for a rather wide class of decision processes. The intimate relationship between the principle and the algorithm is

## Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4A—Control Of Water On The Surface

investigated and certain important conclusions are derived. In addition to the theoretical considerations involved in the implementation of the dynamic programming algorithm, some modeling and computational aspects are also investigated. It is demonstrated that the multistate decision model and the dynamic programming algorithm as defined in this study provide a solid framework for handling a wide class of multisite decision processes. The flexibility of the dynamic programming algorithm as a solution procedure for nonroutine reservoir control problems is demonstrated by two examples, one of which is a reliability problem. Many of the theoretical derivations presented especially those concerning the relation between the principle of optimality and the dynamic programming algorithm, are novel.

W79-03671

**LAND USE/COVER IN THE DEVILS LAKE BASIN, MAY-JUNE, 1975.**  
North Dakota State Univ., Fargo. Dept. of Agricultural Economics.  
For primary bibliographic entry see Field 4D.  
W79-03672

**MANAGEMENT OF SALINE WATER.**  
California Univ., Davis. Dept. of Agricultural Economics.  
For primary bibliographic entry see Field 6B.  
W79-03774

**MAP UNIT COMPOSITION ASSESSMENT USING DRAINAGE CLASSES DEFINED BY LANDSAT DATA.**  
Soil Conservation Service, Lafayette, IN.  
For primary bibliographic entry see Field 7B.  
W79-03802

**GRAVIMETRIC VS. VOLUMETRIC DETERMINATION OF WATER STORAGE IN VERTICALLY UNSTABLE TILLAGE LAYERS,**  
Agricultural Research Organization, Bet Dagan (Israel). Inst. of Soils and Water.  
For primary bibliographic entry see Field 7B.  
W79-03806

**NWS'S FLASH FLOOD WARNING AND DISASTER PREPAREDNESS PROGRAMS,**  
National Weather Service, Silver Spring, MD.  
Disaster Preparedness Staff.  
For primary bibliographic entry see Field 6F.  
W79-03816

### 4B. Groundwater Management

**HEAT STORAGE WELLS: KEY TO LARGE-SCALE COGENERATION.**  
General Electric Co., Santa Barbara, CA. Center for Advanced Studies.  
C. F. Meyer.  
Public Power, p 28-30, July-August 1977, 1 fig.  
OWERT C-5205(No 4210)(7). C-6265(No 5223)(16).

Descriptors: \*Injection wells, \*Aquifers, \*Power system operation, \*Heating, Heat exchangers, Aquifer systems, Water storage, Thermal capacity, Heated water, Heat transfer, Electric power production, Powerplants, Thermal powerplants, Utilities, Industries, Cities.

The concept of heat storage wells as adjuncts to total energy (cogeneration) systems is discussed. Groundwater pumped from a well drilled into a confined saline aquifer passes through a heat exchanger and is injected into another nearby well, the 'hot well', in the same aquifer. When heat is to be used, the water is pumped from the hot well through the heat exchanger, where the heat is removed, and then the water is injected into the warm well which has a higher temperature than the native groundwater. The hydrostatic pressure within the aquifer can maintain water as liquid at temperatures of 350°F. The aquifer material is

warmed by the flow of injected water through the aquifer pores; heat-recovery efficiency increases during successive cycles. The capital cost of wells, the heat exchanger, pumps and auxiliaries is estimated at \$350,000 to \$750,000 for a 20 mw (thermal) module. Costs of building this system on land, rather than drilling wells, are prohibitive. Experience with the 500 to 600 cogeneration systems in the U.S. shows a 25 to 35% energy savings can be achieved. The existing systems utilize small-scale heat storage. Studies indicate that large-scale cogeneration will come about only through securing a utility charter or involving an existing utility. District heating in Europe, and potential implementation of cogeneration systems by municipalities are discussed. (Davidson-IPA)

W79-03586

**NOTES ON A SERIES REPRESENTATION OF THE LEAKY AQUIFER WELL FUNCTION,**  
Nevada Univ. System, Las Vegas. Water Resources Center.  
For primary bibliographic entry see Field 2F.  
W79-03588

**RECHARGE AND GROUNDWATER CONDITIONS IN THE WESTERN REGION OF THE ROSWELL BASIN,**  
New Mexico Inst. of Mining and Technology, Socorro. Dept. of Geosciences.  
For primary bibliographic entry see Field 2F.  
W79-03663

**OUTLOOK FOR ENERGY AND IMPLICATIONS FOR IRRIGATED AGRICULTURE,**  
Texas A and M Univ., College Station. Dept. of Agricultural Economics and Rural Sociology.  
For primary bibliographic entry see Field 3F.  
W79-03667

**THE EFFECTS OF SPARY IRRIGATION ON A MIXED FOREST ECOSYSTEM,**  
New Hampshire Univ., Durham. Dept. of Botany.  
For primary bibliographic entry see Field 5C.  
W79-03679

**MEASUREMENT OF THE ENGINEERING PROPERTIES OF MUNICIPAL INCINERATOR RESIDUES AND CONSIDERATION OF LEACHATE CHARACTERISTICS,**  
Connecticut Univ., Storrs.  
For primary bibliographic entry see Field 5B.  
W79-03685

**ESTIMATING GROUNDWATER RECHARGE FROM CONSERVATION BENCH TERRACES,**  
Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 2F.  
W79-03692

**HANDBOOK FOR HYDROGEOLOGISTS, VOLUME I, (SPRAVOCHNOE RUKOVODSTVO GIDROGEOLOGA).**  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-249 789. Price codes: E00 in paper copy, A01 in microfiche. Report TT 70-57765, Indian National Scientific Documentation Centre, New Delhi (India), 1975. 1033 p, 275 fig, 88 tab, 42 ref. Maximov, V.B., Editor.

Descriptors: \*Canada, \*Publications, \*Hydrogeology, \*Groundwater, Foreign countries, Foreign research, Methodology, Application methods, Technology, Engineering, Engineering education, Education, Schools(Education), Training, Investigations, Agriculture, Aquifers, Springs, Aquifer characteristics, Hydrologic cycle, \*USSR.

The handbook was published in two volumes. The first volume provided information about general and special hydrogeology, principles of dynamics of groundwaters, and the problems of utilizing the groundwater in agriculture. The second edition

dealt with the methods of investigations to be used in hydrogeology and described the means and modes for conducting the hydrogeological studies. The handbook was meant for engineers, technician-hydrogeologists, and other specialists engaged in hydrogeological studies and also for students and teachers of higher educational institutions and technical schools of corresponding specialities. (Froelich-ISWS)

W79-03798

**ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN LYNN AND GARZA COUNTIES, TEXAS, PROJECTIONS OF SATURATED THICKNESS, VOLUME OF WATER IN STORAGE, PUMPAGE RATES, PUMPING LIFTS, AND WELL YIELDS,**

Texas Dept. of Water Resources, Austin.

A. E. Bell, and S. Morrison.

Report 223, September 1978. 68 p, 18 tab, 71 ref, 24 map.

Descriptors: \*Groundwater resources, \*Texas, \*Aquifers, \*Data collections, Groundwater, Maps, Water resources, Aquifer characteristics, Groundwater recharge, Water supply, Groundwater availability, Groundwater mining, Overdraft, Pumping, Projections, Saturated flow, Water wells, Lynn County(Texas), Garza County(Texas), \*Ogallala aquifer(Texas), Pumpage rates, Pumping lifts, Well yields.

This is one of numerous planned county studies covering the declining groundwater resource of the Ogallala aquifer in the High Plains of Texas. The report contained maps, charts, and tabulations which reflect estimates of the volume of water in storage in the Ogallala aquifer in Lynn and Garza Counties and the projected depletion of this water supply by decade periods through the year 2020. The report also contained estimates of pumping, pumping lifts, and other data related to current and future water use in the counties. However, the report does not attempt to project that portion of the volume of the water in underground storage which may be ultimately recoverable. The Ogallala aquifer in Lynn and Garza Counties contained approximately 2.4 million acre-feet of water in 1974. Historical pumping has exceeded 120,000 acre-feet annually, which is more than twice the rate of natural recharge to the aquifer in the counties. This overdraft is expected to continue, ultimately resulting in reduced well yields, reduced acreage irrigated, and reduced agricultural production. (Humphreys-ISWS)

W79-03818

**CONTRIBUTIONS TO THE HYDROGEOLOGY OF ALBERTA.**

Alberta Research Council, Edmonton. Groundwater Div.

For primary bibliographic entry see Field 2F.

W79-03819

**THE HYDROGEOLOGICAL RECONNAISSANCE MAPS OF ALBERTA,**

Alberta Research Council, Edmonton. Groundwater Div.

For primary bibliographic entry see Field 7C.

W79-03820

**APPARENT TRANSMISSIVITY AND ITS DETERMINATION BY NOMOGRAM,**

Alberta Research Council, Edmonton. Groundwater Div.

For primary bibliographic entry see Field 2F.

W79-03821

**SAMPLING OF GROUNDWATERS FOR CHEMICAL ANALYSIS,**

Alberta Research Council, Edmonton. Groundwater Div.

For primary bibliographic entry see Field 2K.

W79-03822

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## Watershed Protection—Group 4D

**CHARACTERISTICS OF PUMPING TESTS CONDUCTED IN HETEROGENEOUS CLASTIC SEDIMENTS OF THE EDMONTON AREA, ALBERTA,**

Alberta Research Council, Edmonton. Ground-water Div.

R. Bibby.

In: Contributions to the Hydrogeology of Alberta, Bulletin 35, Alberta Research Council, Edmonton, p 31-39, 1977. 8 fig, 1 tab, 3 ref.

Descriptors: \*Pumping, \*Drawdown, \*Ground-water, \*Transmissivity, Curves, Aquifers, Wells, Water wells, Discharge(Water), Sedimentary structures, Sedimentary rocks, Geology, Data processing, Classification, Hydrology, Hydrogeology, \*Alberta(Canada), Drawdown curves.

Drawdown curves of pumping tests conducted on 122 wells in the heterogeneous, clastic sediments of the Edmonton area were classified on the basis of their shapes when plotted on a semilogarithmic scale. Four basic shapes were recognized. These shapes, in general, do not conform to any theoretically predicted drawdown curves, and no completely acceptable explanation is known to account for their shape. The last straightline slope of the drawdown curves (and therefore the short-term transmissive capacity as calculated by Jacob's equation) was shown to have a long-normal probability distribution. This is of considerable significance when drawdown curves are used for predictive purposes. (See also W79-03819)(Sims-ISWS) W79-03823

**INVESTIGATION OF THE FEASIBILITY OF DEWATERING BURIED VALLEY SANDS TO AID SEWER-TUNNEL EXCAVATIONS, EDMONTON, ALBERTA,**

Alberta Research Council, Edmonton. Ground-water Div.

For primary bibliographic entry see Field 8D. W79-03824

**DISPLOT: A COMPUTER PROGRAM FOR TRANSLATING DOMINION LAND SURVEY COORDINATES TO UNIVERSAL TRANSVERSE MERCATOR COMPATIBLE COORDINATES,**

Alberta Research Council, Edmonton. Ground-water Div.

For primary bibliographic entry see Field 7C. W79-03826

**PUBLIC GROUNDWATER SUPPLIES IN HENDERSON COUNTY,**

Illinois State Water Survey, Urbana. D. M. Wooller, and E. W. Sanderson.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 780, Price codes: A02 in paper copy, A01 in microfiche. Bulletin 60-23, 1978. 20 p, 2 fig.

Descriptors: \*Water supply, \*Illinois, \*Ground-water resources, \*Well data, Unconsolidated aquifers, Gravels, Sand aquifers, Bedrock, Sandstones, Dolomite, Groundwater availability, Groundwater, Water sources, Water quality, Water wells, Data collections, Municipal water, Water yield, Water properties, Hardness(Water), Chemical properties, Deep wells, Shallow wells, Geology, Aquifers, Drillers logs, Henderson County(IL), Dissolved minerals, Water bearing formations.

All available information on production wells used for public groundwater supplies in Henderson County, Illinois, was presented. The definition of public water supply as contained in the Environmental Protection Act of 1970 was used to determine those water systems and wells to be included. The report included separate descriptions for groundwater supplies of 6 municipalities and 1 state park. These were preceded by brief summaries of the groundwater geology of the county and the development of groundwater sources for public use. Individual production wells for each supply were described in the order of their construction. The description for each well included

the aquifer or aquifers tapped, date drilled, depth, driller, legal location, elevation in feet above mean sea level, log, construction features, yield, pumping equipment, and chemical analysis. (Humphreys-ISWS) W79-03827

**A CASE STUDY-NITRATES IN THE UPPER SANTA ANA RIVER BASIN IN RELATION TO GROUNDWATER POLLUTION,**

California Univ., Davis. Dept. of Land, Air and Water Resources.

For primary bibliographic entry see Field 5B. W79-03955

**4C. Effects On Water Of Man's Non-Water Activities****THE EFFECTS OF MOTORWAY CONSTRUCTION ON AN URBAN STREAM,**

Polytechnic of Central London (England).

For primary bibliographic entry see Field 5C. W79-03639

**MOTORBOAT USE ON THE WILD ROGUE RIVER: AN INVESTIGATION OF USE BETWEEN WATSON CREEK AND BLOSSOM BAR,**

Oregon State Univ., Corvallis. Dept. of Geography.

For primary bibliographic entry see Field 5B. W79-03695

**WILDLIFE CONFLICTS IN RIPARIAN MANAGEMENT: GRAZING,**

Coronado National Forest, Tuscon, AZ. C. R. Ames.

In: Importance, Preservation and Management of Riparian Habitat: A Symposium, July 9, 1977, Tuscon, Arizona, USDA Forest Service General Technical Report RM-43, p. 49-51, 6 fig.

Descriptors: \*Riparian land, \*Riparian plants, \*Grazing, \*Cattle, Effects, Wetlands, Southwest U.S., Arizona, Livestock, Eutrophication.

Because of its high moisture content, riparian forage is highly palatable to cattle; and, availability of water and shade in riparian areas provide a strong influence for livestock to frequent such areas. Protection of riparian habitat from the negative effects of grazing can only be effectively achieved through fencing. (Stihler-Mass) W79-03710

**WILDLIFE CONFLICTS IN RIPARIAN MANAGEMENT: WATER,**

Forest Service, Albuquerque, NM.

For primary bibliographic entry see Field 6G. W79-03711

**MANAGEMENT ALTERNATIVES FOR RIPARIAN HABITAT IN THE SOUTHWEST,**

Apache-Sitgreaves National Forest, Springerville, AZ.

For primary bibliographic entry see Field 6G. W79-03712

**SOME EFFECTS OF A CAMPGROUND ON BREEDING BIRDS IN ARIZONA,**

Museum of Northern Arizona, Inc., Flagstaff. S. W. Aitchison.

In: Importance, Preservation and Management of Riparian Habitat: A Symposium, July 9, 1977, Tuscon, Arizona, USDA Forest Service General Technical Report RM-43, p. 175-182. 1 fig, 5 tab, 31 ref.

Descriptors: \*Recreation, \*Camp sites, \*Birds, \*Effects, \*Arizona, Vegetation, Riparian land, Trees, Wildlife, Habitats, Camping, Wetlands, Streams.

Over a three-year period, breeding bird densities were found to be similar between a constructed campground and a relatively natural area when the campground was closed to campers. However, bird species composition differed between sites, the campground having relatively heavier bodied birds ( $x = 48.5$  g) than the control area ( $x = 38.2$  g). Once the campground was opened for human use, the breeding bird population decreased in density and diversity. On the control site the population either remained the same or increased. Locations for new campgrounds should be carefully scrutinized in terms of usage by wildlife; riparian habitats are important to birds and further destruction of this habitat in the Southwest needs to be discouraged. (Stihler-Mass) W79-03724

**IMPORTANCE, PRESERVATION, AND MANAGEMENT OF RIPARIAN HABITAT: AN OVERVIEW,**

Museum of Northern Arizona, Inc., Flagstaff. Dept. of Biology.

For primary bibliographic entry see Field 6G. W79-03729

**THE EFFECTS OF DITCHING A SALT MARSH ON COLONY AND NEST SITE SELECTION BY HERRING GULLS (LARUS ARGENTATUS),**

Livingston Coll., New Brunswick, NJ. Dept. of Biology.

For primary bibliographic entry see Field 6G. W79-03752

**4D. Watershed Protection****SCOUR AND FILL PATTERNS IN POOL-RAPID RIVERS,**

Arizona Univ. Tucson. Dept. of Civil Engineering and Engineering Mechanics.

For primary bibliographic entry see Field 2J. W79-03668

**LAND USE/COVER IN THE DEVILS LAKE BASIN, MAY-JUNE, 1975,**

North Dakota State Univ., Fargo. Dept. of Agricultural Economics.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 615. Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Inst., North Dakota State University, Research Project Technical Paper, WI-321-001-77, June 15, 1977. 13 p, 2 fig, 11 tab. OWRT A-043-NDAK(2), 14-31-0001-5034.

Descriptors: \*Land use, \*Land management, Water management(Applied), Water utilization, \*Watershed management, Watersheds(Basins), Flood control, \*Classification, \*North Dakota, North Central Region(ND), \*Devils Lake Basin(ND).

Land use/cover data are presented as classified by EPIC (Warrenton, Virginia) for May and June, 1975, for the Devil Lake Basin and for each watershed: Hurricane Lake Watershed, Stump Lake Watershed, Edmore Watershed, Starkweather Watershed, Chain Lakes Watershed, Mauvais Coules Watershed, Devils Lake Watershed, South Slope Watershed. This information is important when considering water on land management alternatives for the Devils Lake Basin. W79-03672

**ADSORPTION AND DESORPTION IN MINE DRAINAGES,**

Colorado School of Mines, Golden.

For primary bibliographic entry see Field 5B. W79-03673

**ACTUAL EVAPOTRANSPIRATION OVER A SUMMER PERIOD IN THE 'HUPSEL CATCHMENT,**

Agricultural Univ., Wageningen (Netherlands) Dept. of Hydraulics and Catchment Hydrology

## Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4D—Watershed Protection

For primary bibliographic entry see Field 2D. W79-03813

## 5. WATER QUALITY MANAGEMENT AND PROTECTION

### 5A. Identification Of Pollutants

#### ISOLATION OF A MERCURIC CHLORIDE-TOLERANT BACTERIUM AND UPTAKE OF MERCURY BY THE BACTERIUM.

Gifu Univ. (Japan). Dept. of Agricultural Chemistry.

For primary bibliographic entry see Field 5C. W79-03501

#### DESIGN AND ANALYSIS OF AQUATIC MONITORING PROGRAMS AT NUCLEAR POWER PLANTS.

Battelle Pacific Northwest Labs., Richland, WA. For primary bibliographic entry see Field 5G. W79-03566

#### AQUATIC AND TERRESTRIAL SURVEYS IN THE VICINITY OF POWER PLANTS USING REMOTE SENSING.

Calspan Corp., Buffalo, NY.

J. R. Schott, and D. W. Gaucher.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 463. Price codes: A04 in paper copy, A01 in microfiche. New York State Energy Research and Development Authority, New York, NY., Report NY-SERDA 75/31, April 1977. 66 p, 12 fig, 8 tab, 11 ref.

Descriptors: Environmental effects, \*Monitoring, \*Air pollution, \*Water pollution, Thermal pollution. Powerplants, Analytical techniques, \*Remote sensing, Reflectance, Photometry, Surveys.

This study attempts to define, develop and demonstrate the capabilities of remote sensing for monitoring the effects of stack emissions and thermal discharge on the environment. The extent to which the reflectance properties of elements in the environment as measured from aerial photography could be related to the condition of the environment was examined. Program results indicated that vegetative stress in a forested environment can be related to reflectance signatures as measured from aerial imagery. In water quality studies, relationships between reflectance and chlorophyll concentration, suspended material and yellowing organics were shown. Data collected from aerial and boat measurements and combined with laboratory modeling showed that measurement of certain effects of thermal discharges on the aquatic environment is possible. (Chilton-ORNL) W79-03567

#### EVALUATION OF VINYL CHLORIDE EMISSIONS IN THE LONG BEACH AREA, CALIFORNIA.

National Field Investigations Center-Denver, CO. For primary bibliographic entry see Field 5B. W79-03577

#### POLAROGRAPHIC DETERMINATION OF LEAD HYDROXIDE FORMATION CONSTANTS AT LOW IONIC STRENGTH.

Geological Survey, Menlo Park, CA. Water Resources Div.

C. J. Lind.

Environmental Science and Technology, Vol 12, No 13, p 1406-1410, December 1978. 2 fig, 4 tab, 15 ref.

Descriptors: \*Lead, \*Polarographic analysis, \*Freshwater, \*Chemical reactions, \*Ions, \*Aqueous solutions, Chelation, Analytical techniques, Water chemistry, Heavy metals, Trace elements, Pollutants, Graphical methods, Evaluation, \*Metal

hydroxides, Molecular concentrations, Formation constants.

Values for the formation constants for lead hydroxide complexes containing one, two, and three hydroxide ligands have been determined at 0.01 M ionic strength. These constants can be directly applied to many freshwaters. Generally, however, applications should involve use of the constants corrected to zero ionic strength by using appropriate activity coefficients corresponding to the ionic strength of the solution being considered. (Woodard-USGS) W79-03592

#### UTILIZATION OF THE STEAM DISTILLATION PROCEDURE FOR THE DETERMINATION OF METHYL MERCURY IN FISH AND SHELLS BY GAS-LIQUID CHROMATOGRAPHY, (IN JAPANESE).

Yamaguchi Prefectural Research Inst. of Health, Japan.

H. Kumagai, and K. Saeki.

Bulletin of the Japanese Society of Scientific Fisheries, Vol. 44, No. 7, p 803-805, 1978. 1 fig, 3 tab, 8 ref.

Descriptors: \*Mercury, \*Gas chromatography, Pollutant identification, Heavy metals, Chlorides, Organic compounds, Chemical analysis, Path of pollutants, Chemical reactions, Absorption, Animal metabolism, Fish physiology, Clams, Oysters, Shrimp, Marine fish, Tissue analysis, \*Mercury compounds, \*Methylmercury.

In this connection, the steam distillation procedure has been applied for the determination of methyl mercury in fish and shells by gas-liquid chromatography. The procedure adapted herein involves steam distilling volatile alkyl mercurials as mercuric chlorides. The mercuric chlorides in the distillate are extracted with benzene, and the benzene phase is partitioned with a cysteine acetate solution. Methyl mercuric chloride in the aqueous phase is determined by electron capture gas-liquid chromatography using alpha-chloronaphthalene as an internal standard. (EIS-Deal) W79-03635

#### CADMUM AND ZINC IN MUSCLE OF BLUEGILL (LEPOMIS MACROCHIRUS) AND LARGEMOUTH BASS (MICROPTERUS SALMOIDES) FROM AN INDUSTRIALLY CONTAMINATED LAKE.

Purdue Univ., Lafayette, IN. Dept. of Bionucleonics.

B. R. Murphy, G. J. Atchison, and A. W.

McIntosh.

Environmental Pollution, Vol. 17, p 253-257, 1978. 3 tab, 18 ref.

Descriptors: \*Cadmum, \*Zinc, \*Sunfishes, \*Bass, Pollutant identification, Chemical analysis, Heavy metals, Metals, Water chemistry, Public health, Human pathology, Food habits, Fish food organisms, Fish physiology, Animal metabolism, Industrial wastes, Chemical wastes, Water analysis, Indiana, Palestine Lake, \*Tissue analysis, \*Bioaccumulation.

Cadmum and zinc analyses of 44 largemouth bass and 29 bluegill indicate that fish in an ecosystem heavily contaminated by trace metals accumulate significantly more metal in edible muscle tissue than do fish in an uncontaminated ecosystem. Concentrations detected ranged from 0.010 to 1.308 ppm Cd and 18.2 to 158.2 ppm Zn (dry weight). Bluegill contained significantly greater concentration of Cd and Zn than did bass and small bass contained significantly more Cd than did large bass. Human consumption of these fish is probably not a health hazard unless such fish constitute a major portion of the diet. (EIS-Deal) W79-03650

#### 237PU EXPERIMENTS WITH THE THORNBACK RAY RAJA CLAVATA,

Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Radiobiological

Lab. with the methods of physiologics in the used R. J. Pentreath. *Marine Biology*, Vol. 48, p 337-342, 1978. 1 fig, 8 tab, 6 ref.

Descriptors: \*Radioisotopes, \*Tracers, Animal metabolism, Animal physiology, Chemical analysis, Radiochemical analysis, Path of pollutants, Absorption, Radiation, Gamma rays, \*Plutonium, \*Rays, Raja, Tissue analysis, Bioaccumulation, \*Depuration, \*Transuranic elements.

Some experiments have been performed on the metabolism of 237Pu, a high specific activity, gamma-emitting isotope of plutonium, by the thornback ray. Unlike previous experiments with the plaice it was found that the thornback ray absorbed plutonium across the gut wall, as readily observed by analysis of the liver. The liver accumulated up to 0.2% of the 237Pu given in a single labelled meal after a period of 12 days. Direct injection of the isotope into the muscle of thornback rays resulted in extremely slow rates of elimination from the fish, the highest internal concentrations being attained by the spleen. The largest fractions of the whole-body burden, however, were those of liver and skeleton. (EIS-Deal) W79-03649

#### THE SELECTION AND LIMITATIONS OF PHENOL AS A REFERENCE TOXICANT TO DETECT DIFFERENCES IN SENSITIVITY AMONG GROUPS OF RAINBOW TROUT (SALMO GAIRDNERI).

Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.

D. G. Alexander, and R. Mc. V. Clarke.

Water Research, Vol. 12, p 1085-1090, 1978. 3 tab, 17 ref.

Descriptors: \*Phenols, \*Rainbow trout, \*Bioassay, Analytical techniques, Laboratory tests, Fish physiology, Animal metabolism, Sodium compounds, Copper sulfate, Sulfates, Chlorine, Toxicity, Mortality, Resistance, Fish behavior, Fish populations, \*Reference toxicants.

Phenol was better than sodium azide, sodium pentachlorophenate, copper sulphate and dodecylsodium sulphate in detecting differences in sensitivity among groups of rainbow trout. Phenol detected differences in sensitivity among strains of trout and could discern the effects of starvation, temperature, stress and pre-exposure to 0.04 mg/l-1 chlorine on the sensitivity of trout to phenol, but not the effects of three brands of food and high mortality during holding. The sensitivity of rainbow trout to phenol was independent of weight and loading density in the bioassays. The use of phenol as a reference toxicant for the rapid detection of differences in sensitivity among groups of fish is limited because differences can only be detected by comparing the sensitivity of an unknown group of fish to that of a known, unstressed group of fish in the same bioassay. The concept of a single reference toxicant appropriate for bioassays with a variety of chemicals is questionable because differences among groups of fish, which are detectable by a reference toxicant, may not affect the results of bioassays with other chemicals. A series of physiological and behavioural screening tests and diagnostic health checks may be more useful than reference toxicants to identify groups of fish which should not be used in bioassays. (EIS-Deal) W79-03655

#### BENTHIC MACROINVERTEBRATE COMMUNITIES OF THE PENOBSCOT RIVER, MAINE, WITH SPECIAL REFERENCE TO THEIR ROLE AS WATER QUALITY INDICATORS.

Maine Univ. at Orono.

C. F. Rabeni.

Available from the National Technical Information Service, Springfield, VA. 22161 as PB-290 563. Price codes: A08 in paper copy, A01 in microfiche. PhD Thesis, January 1977. 169p, 15 fig, 7 tab, 9 ref, 7 append. OWRT A-028-ME(2).

Descriptors: \*Bioindicators, Invertebrates, Analysis, Classification, Current velocity, Detritus, Dis-

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## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Identification Of Pollutants—Group 5A

solved oxygen, Invertebrates, Pulp and paper effluents, Rivers, Sampling, Standing crops, Tinity, Water chemistry, Water quality, Water temperature, \*Maine, Pollutant identification, \*Penobscot River(ME), \*Benthic macroinvertebrates, Bray-Curtis ordination, Hess sampler, Pollution-stressed/clean water communities, Siltation, Water depth.

This study was designed to develop a system for using benthic macroinvertebrates as water quality indicators in a large deep river. Project objectives were: (1) to develop reliable sampling techniques; (2) to determine whether pollution-stressed communities were predictively different from clean water communities; and (3) to determine the range of, and environmental factors responsible for, variations in the structures of clean water communities. Two sampling methods were of value—(1) a modified Hess sampler which obtained a more representative sample of actual standing crop, and (2) rock-filled baskets secured to the river bottom, which collected a greater number of individuals and taxa. Indicator organisms were not particularly sensitive, and species diversity was often misleading. An efficient water quality classification system was developed using the Bray-Curtis ordination, which was sensitive to changes in the faunal community structure caused by pulp and paper mill effluents. Invertebrates were better indicators of certain types of pollution than were standard physical and chemical methods. Analysis also indicated that the composition of clean water invertebrate communities were partially determined by current velocity, siltation, and organic detritus, and was not affected by water temperature, turbidity, dissolved oxygen, water depth, and water chemistry. W79-03669

**EFFECTS OF TRACE ELEMENTS ON NITRIFICATION IN SOILS,**  
Iowa State Univ., Ames, Dept. of Agronomy.  
C. N. Liang, and M. A. Tabatabai.  
Journal of Environmental Quality, Vol. 7, No. 2, p. 291-293, April-June, 1978. 3 tab, 15 ref.

Descriptors: \*Bioassay, \*Tests, Fish community, Toxicity, Fish population.

sodium pentoxide, dodecylsulfate, in sensitivity to detection of trout and salmon, temperature, Hg(II), but not high mortality, rainbow trout and loading phenol as a function of different fish is limited by a group of fish in the single reference in a variety of differences detectable by a the results of species of physiologists and diagnostic useful than of fish which (Deal)

studies to evaluate the effects on nitrification of 19 trace elements showed that all these elements inhibited nitrification of  $\text{NH}_4^+$ -N added to soils. Results showed that the relative effectiveness of the trace elements in inhibition of nitrification depends on the soils. When the trace elements were compared to using 5 micromoles/g of soil, Ag(I), Hg(II), Cd(II), As(III), Cr(III), B(III), Al(III), Se(IV), and Mo(VI) were the most effective inhibitors, and Mn(II) and Pb(II) the least effective (average inhibition greater than 25 percent) inhibitors. The average inhibition by the elements Co(II), Cu(II), Sn(II), Fe(II), Zn(II), Fe(III), V(IV), and W(VI) ranged from 33 percent with W(VI) to 49 percent with Fe(III). Silver(I), Ni(II), Co(II), Zn(II), Mn(II), Pb(II), As(III), B(III), Fe(III), As(V), Mo(VI), and W(VI) inhibited Nitrobacter, causing accumulation of  $\text{NO}_2^-$ -N in one of the soils used. (Skogboe-Colorado State) W79-03705

**PHOTOPLANKTON NITROGEN METABOLISM, NITROGEN BUDGETS, AND OBSERVATIONS ON COPPER TOXICITY: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT,**  
California Univ., San Diego, La Jolla. Inst. of Marine Resources.

W. G. Harrison, R. W. Eppley, and E. H. Renger. Bulletin of Marine Science, Vol 27(1). p 44-57, 1977. 9 tab, 6 fig, 40 ref.

Descriptors: \*Phytoplankton, \*Nitrogen, \*Growth rates, \*Copper, \*Heavy metals, \*Photosynthesis, Toxicity, Mortality, Water pollution effects, Path of pollutants, Resistance, Bioassay, \*Plant growth, Plant physiology, On-site-investigation, Metabolism, \*Controlled experimental ecosystem, \*Nitrogen metabolism, Nitrogen budgets, Noctiluca sp., Nitrate reductase assays, \*Nutrient loading.

Phytoplankton growth and nitrogen metabolism seemed typical of coastal temperate plankton in the 0.25-scale CEPEX enclosures used at Saanich Inlet, B.C., in the summer of 1974. Maximum rates of nitrogen assimilation corresponded to a growth rate of about 1.0 day<sup>-1</sup> and half-saturation rates on a day-to-day basis were regulated primarily by ambient nitrate and ammonium levels, overall phytoplankton levels and settlement rates were related to the rate of nutrient loading. Remineralization of nitrogen to ammonium was rapid and important. Although only nitrate (along with phosphate and silicate nutrients) were added to the enclosures, rates of ammonium assimilation by the phytoplankton were similar to those for nitrate. Several acute effects of copper on phytoplankton were observed, including inhibition of nitrate uptake, photosynthetic carbon assimilation, synthesis of nitrate reductase, and cell disruption and loss of accumulated ammonium in *Noctiluca* sp. Evidence suggests that the addition of copper to the enclosures resulted in acute inhibition of phytoplankton growth and replacement of the initial phytoplankton by a copper-tolerant assemblage. Bioassay experiments indicated that even after the shift to copper-tolerant forms, (1) the copper in the enclosures remained in a chemical form still toxic to phytoplankton from control enclosures, and (2) the degree of copper-tolerance of the phytoplankton was related to ambient copper concentrations. (Katz)

W79-03738

**A GEOCHEMICAL STUDY OF A MARSH ENVIRONMENT,**  
Gulf Coast Research Lab., Ocean Springs, MS.  
For primary bibliographic entry see Field 2K.  
W79-03743

**ROLE OF INORGANIC CARBON AVAILABILITY IN THE FORMATION OF NUISANCE BLOOMS OF BLUE-GREEN ALGAE,**  
Oklahoma State Univ., Stillwater. Dept. of Biological Sciences.

For primary bibliographic entry see Field 5C.

W79-03762

**EFFECTS OF POLYCHLORINATED BI-PHENYL COMPOUNDS AND PROPOSED PCB-REPLACEMENT PRODUCTS ON EMBRYO-LARVAL STAGES OF FISH AND AMPHIBIANS,**  
Kentucky Water Resources Research Inst., Lexington.

For primary bibliographic entry see Field 5C.

W79-03763

**DETERMINATION OF PHOSPHATE BY CATHODIC STRIPPING CHRONOPOTENTIOMETRY AT A COPPER ELECTRODE,**  
Southern Illinois Univ., Carbondale. Dept. of Chemistry and Biochemistry.

G. L. Lundquist, and J. A. Cox. Analytical Chemistry, Vol. 46, No. 3, p. 360-364, March 1974, 4 fig, 4 tab. OWRR A-041-ILL(2), USDI 14-31-0001-3213.

Descriptors: \*Phosphates, \*Trace elements, \*Electrodes, \*Electrochemistry, \*Pollutant identification, Electrochemical stripping, Electrolysis potential, Copper electrode.

A method for the determination of phosphate based upon stripping of an electrochemically deposited cupric phosphate film has been developed. The film consists of a mixture of Cu(II) salts of the conjugate bases of  $\text{H}_3\text{PO}_4$  with the  $\text{HPO}_4^{2-}$  salt being the major component in the analytical pH range. Linear working curves over single orders-of-magnitude down to 20 ppb phosphate have been obtained. The percent standard deviation varies from 20% to 20 ppb to within 3% at concentrations above 1 ppm. The detection limit is 10 ppb when a 20-minute electrolysis is used. Chemical dissolution of the film in competition with electrochemical stripping and the appearance of a blank transition due to reduction of cupric ion in the reaction layer establish the detection limit.

W79-03769

**VOLTAMMETRIC DETERMINATION OF TRACE QUANTITIES OF NITRATE IN AN ANION EXCHANGE MEMBRANE ISOLATED CELL,**

Southern Illinois Univ., Carbondale. Dept. of Chemistry and Biochemistry.  
G. L. Lundquist, G. Washinger, and J. A. Cox. 4-31-0001-3213.

Descriptors: \*Nitrates, Analytical techniques, \*Volumetric analysis, Membranes (Anion exchange), \*Pollutant identification, Water analysis, Electrolysis, Electrolytes.

Polarographic and spectrophotometric methods for the determination of trace quantities of nitrate have significant limitations for field investigations. The proposed method is based upon the reduction of nitrate by linear potential scan voltammetry at a stationary mercury drop electrode in a small volume electrolysis cell. The cell is isolated from the test solution by an anion exchange membrane. The membrane serves to preconcentrate the nitrate in the electrolysis chamber and also prevents net loss of the supporting electrolyte from the chamber. Hence, a dip-type system may be designed for direct voltammetric measurements in low ionic strength media. Experimental results demonstrate that linear scan voltammetry determinations in samples of low-to-moderate ionic strength. Surfactants, chloride and cations do not interfere which makes the method attractive for natural water samples.

W79-03771

#### WATER SYSTEM VIRUS DETECTION,

National Aeronautics and Space Administration Washington, DC. (Assignee).

J. C. Fletcher, A. S. Fraser, A. F. Wells, and H. J. Tenoso.

U.S. Patent No. 4,118,315, 7 p, 3 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 1, p. 258, October 3, 1978.

Descriptors: \*Patents, \*Monitoring, \*On-site tests, \*Water quality control, Recirculated water, Reclaimed water, Water reuse, Viruses, Performance, Pollutant identification.

In a closed environment system, such as exists in a spacecraft, it is necessary to recycle waste products to the maximum extent. Water is a particular commodity which must be recycled. The object of this invention is to monitor the performance of a waste water reclamation system whereby early detection of any system malfunction is obtained. The performance is monitored by introducing a non-pathogenic marker virus, bacteriophage F2, into the waste-water prior to treatment and, thereafter, testing the reclaimed water for the presence of the marker virus. A test sample is first concentrated by absorbing any marker virus onto a cellulose acetate filter in the presence of a trivalent cation at low pH and then flushing the filter with a limited quantity of a glycine buffer solution to desorb any marker virus present on the filter. Photo-optical detection of indirect passive immune agglutination by polystyrene beads indicates the performance of the water reclamation system in removing the marker virus. A closed system provides for concentrating any marker virus, initiating and monitoring the passive immune agglutination reaction, and then flushing the system to prepare for another sample. Peristaltic pumps are provided for volumetric control and for positive fluid displacement. Solenoid valves direct the output from the pumps in preselected routes to accomplish the process for concentrating and detecting the marker virus. (Sinha-OEIS) W79-03784

**SCENARIO FOR AN ONGOING CHLOROPHYLL A SURVEILLANCE PLAN ON LAKE ONTARIO FOR NON-INTENSIVE SAMPLING YEARS,**

Canada Centre for Inland Waters, Burlington (Ontario).

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

## Group 5A—Identification Of Pollutants

R. E. Kwiatkowski.  
Journal of Great Lakes Research, Vol. 4, No. 1, p 19-26, March 1978. 4 fig, 3 tab, 1 ref.

Descriptors: \*Sampling, \*Canada, \*Chlorophyll, \*Lake Ontario, Surveys, Data collections, On-site investigations, Data processing, Statistics, Seasonal, Distribution patterns, Lakes, Nutrients, Water quality.

This study proposed an effective, non-intensive sampling program for chlorophyll a on Lake Ontario. Three years of chlorophyll data were used to establish three statistically homogeneous zones, significantly different at the 5% level. These zones were referred to as offshore, inshore, and point source areas. The seasonal cycle for each zone was presented as was the number of samples needed to estimate the mean of each zone within 1%, 5%, and 10% of the true mean, with a 95% confidence level. (Sims-ISWS)  
W79-03808

## MIREX IN THE SEDIMENTS OF LAKE ONTARIO.

Ontario Ministry of Agriculture and Food, Guelph. Pesticide Residue Lab.  
For primary bibliographic entry see Field 5B.  
W79-03810

## SAMPLING OF GROUNDWATERS FOR CHEMICAL ANALYSIS,

Alberta Research Council, Edmonton. Groundwater Div.  
For primary bibliographic entry see Field 2K.  
W79-03822

## SYMPOSIUM: EXPERIMENTAL USE OF ALGAL CULTURES IN LIMNOLOGY; SANDEFJORD, NORWAY, 26-28 OCTOBER 1976.

Internationale Vereinigung fuer Theoretische und Angewandte Limnologie, Stuttgart (Germany, F.R.).

For primary bibliographic entry see Field 5C.  
W79-03842

## ALGAL ASSAY PROCEDURE WITH ONE OR FIVE SPECIES, MINITEST,

Uppsala Univ. (Sweden). Algal Assay Lab.

A. Clasesson, and A. Forsberg.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung fuer Theoretische und Angewandte Limnologie, Mittellungen No 21, June 1978, p 21-30. 6 fig, 2 tab, 13 ref.

Descriptors: \*Testing procedures, \*Bioassay, \*Methodology, \*Minitest, \*Bottle test, \*Algae, Cultures, *Selenastrum capricornutum*, *Ankistrodesmus falcatus*, *Chlorella homosphaera*, *Euglena gracilis*, *Scenedesmus quadricauda*, Plant growth, Toxicity, Waste water (Pollution), Algal growth potential, Limiting factors, Carbon, Water pollution effects, Lakes, Eutrophication.

A miniature version of the standard algal assay bottle test, called the Minitest, yields results essentially the same as with the conventional test, which must be modified for large-scale screening application. Minitests are performed in small plastic tubes containing a culture volume of 2.5 ml. This paper describes two Minitest methods: (1) *Selenastrum capricornutum* as a single test alga, routinely used for determining maximum algal growth potential (AGP) and limiting nutrients in lake water; and (2) a combination of *S. capricornutum*, *Ankistrodesmus falcatus*, *Chlorella homosphaera*, *Euglena gracilis*, and *Scenedesmus quadricauda* mixed on an equal cell volume basis, used to estimate AGP and indicate toxic effects of wastewater. All algae are axenically grown in Z8 medium except *Euglena*, grown in Wollen's medium (1961). Preparation of the inoculum involves three phases: (1) stock cultures kept one week in 20% Z8 or *Euglena* medium in E-flasks; (2) starving in P-free, N-poor medium for one week; and (3) mixing of starved algae on an equal cell volume basis, giving a 'standard recipient.' Incubation is normally three

days for wastewater and two weeks for lake water. Whereas carbon deficiency is common in algal assays, Minitest cultures did not require carbon dioxide bubbling or HCO<sub>3</sub> enrichment when punched stoppers were used. (See also W79-03842)  
W79-03844

## THE CULTURE COLLECTION POINT OF VIEW.

Culture Centre of Algae and Protozoa, Cambridge (England).

E. A. George.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung fuer Theoretische und Angewandte Limnologie, Mittellungen No 21, June 1978, p 31-33.

Descriptors: \*Cultures, \*Algae, \*Testing, \*Storage, \*Basic data collections, Methodology, Classification, *Chlorella*, Storage, Storage requirement, Nitrogen, Freeze drying, Culture media, Service collections, Data processing, Bacteria, Fungi, Protozoa, Survival.

Techniques of maintaining service collections of algae, fungi, or bacteria are described. A service-oriented collection should maintain and supply all worthwhile cultures within its interest area and collects and supplies information relating to them. Most strains are either taxonomic types or the subjects of other published research. Essential or valuable procedures include: (1) recording of full and accurate data when a strain is deposited, (2) careful labelling, (3) keeping a record of issue of strains, (4) reference to strains in publications, and (5) maintenance of a collection of user publications. Most algal strains are maintained as active cultures needing subculturing every few months or even weeks, but progress is being made towards preservation by freezing or drying. The Culture Centre of Algae and Protozoa (Cambridge, United Kingdom) now has all of its *Chlorella* strains and many other Chlorococcales under liquid nitrogen, and survival is usually over 90%. The main external factors affecting survival are growth temperature prior to freezing, age of cultures, possible use of protective additives, and rate of cooling and thawing. The World Federation of Culture Collections has published a world directory of data on culture collections and of the species they hold, and are now in the process of banking data on every strain in culture. (See also W79-03842)  
W79-03845

## PHYSIOLOGICAL INDICATORS OF NUTRIENT DEFICIENCY IN ALGAE.

Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.

F. P. Healey.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung fuer Theoretische und Angewandte Limnologie, Mittellungen No 21, June 1978, p 34-41. 5 fig, 7 ref.

Descriptors: \*Algae, \*Plant physiology, \*Bioindicators, \*Nutrient deficiency, \*Limiting factors, \*Methodology, Analytical techniques, Nutrients, Essential nutrients, *Anabaena variabilis*, Canada, Lakes, Cultures, Phosphorus, Nitrogen, Phosphates, Phosphatases, Metabolism, On-site tests.

Cultural studies have shown that a number of kinds of algae respond in a qualitatively manner to nutrient deficiencies. This paper demonstrates that: (1) such qualitative generalizations can be converted into quantitative terms for most algae, and (2) the cultural data is comparable to data for natural populations and can be used to quantify nutrient deficiencies in natural populations. Phosphorus deficiency generally lowers phosphorus content, and causes increased alkaline phosphatase activity and ability to take up phosphate. Nitrogen deficiency lowers the nitrogen content, while increasing the ability to take up ammonium. Lowered chlorophyll and protein with raised carbohydrate contents are general responses to nutrient deficiency.

Physiological responses to phosphorus deficiency is illustrated using *Anabaena variabilis*. Effects of nutrient deficiency on nitrogen and phosphorus content of a variety of algae are described and figured; algal types include chlorophytes, cyanophytes, diatoms, chrysophytes, and dinoflagellates. Indicators of nutrient deficiency taken from cultural studies are then compared with results of field studies conducted at several central Canadian lakes, including the south basin of Lake Winnipeg, South Indian Lake, and a small prairie lake in Manitoba. (See also W79-03842) (Lynch-Wisconsin)  
W79-03846

## A MODIFIED TURBIDOSTATIC SYSTEM FOR ALGAL POPULATION STUDIES,

Euratom European Community, Varese (Italy).

G. Premazzi, O. Ravera, and A. Lepers.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung fuer Theoretische und Angewandte Limnologie, Mittellungen No 21, June 1978, p 42-49. 6 fig, 2 tab, 7 ref.

Descriptors: \*Algae, \*Phytoplankton, \*Turbidostats, \*Bioassay, \*Testing procedures, \*Laboratory equipment, Research equipment, Methodology, Continuous flow, Pollutants, *Selenastrum minutum*, Primary productivity, Cadmium, Nutrients, Culture media, Chlorophyta.

A new type of turbidostat has two important advantages: (1) population density is controlled by a photodetector sensor with one threshold, and (2) the difference between the photoelectrical relays is minimized. In addition to comparing the growth rate of algal populations cultivated on media with different macro- and micro-nutrients, the system may record quantitatively and continuously the effects of any pollutant on the primary production of algal populations. The system is illustrated with an experiment on effects of low concentrations of cadmium salts on a population of the chlorophyte *Selenastrum minutum*. Variation in population density is the most common parameter used to measure effects of a pollutant, and planktonic algae and other microorganisms with a fast turnover rate are often used to assay pollutants. A turbostat controls growth internally—rate of flow is controlled by cell density. Essential features of a turbidostat include: (1) an optical balance which compares the optical density of the culture with that of a reference, and (2) a feed-back loop by which a voltage signal operates on an on-off valve in a fresh medium line. The new turbidostat comprises a culture vessel in which cells are grown isolated from contamination, a nutrient supply system, a culture agitation system, an optic-electronic system with a photodetector to monitor population density, and a system of drainage that removes fluid from the culture vessel as the same rate as the fresh medium is supplied. (See also W79-03842) (Lynch-Wisconsin)  
W79-03847

## SOLUBILIZATION OF BIOLOGICALLY AVAILABLE PHOSPHORUS BY AUTOCLAVING SELENASTRUM,

FMC Corp., Princeton, NJ. Research and Development Dept.

J. Saldick, and J. F. Jadlocki, Jr.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung fuer Theoretische und Angewandte Limnologie, Mittellungen No 21, June 1978, p 50-56. 4 tab, 5 ref.

Descriptors: \**Selenastrum capricornutum*, \*Phosphorus, \*Bottle test, \*Bioassay, \*Autoclaves, \*Testing procedures, Solubility, Plant growth, Phytoplankton, Algae, Nutrients, Phosphates, Methodology, Limiting factors, Eutrophication, Lakes, Streams, Chlorophyta.

EPA's manual for use of the algal assay bottle test in studies of the nutritional state of lakes and streams recommends either filtration alone or autoclaving for sample pretreatment before inoculation with test algae. The present experiments were undertaken to measure the fraction of algal cell phos-

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## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification Of Pollutants

Limiting factors, Freshwater, Limnology, Michaelis-Menten equations, Semicontinuous cultures, Plant growth, Growth rates.

The Monod constant yield model and the variable internal stores model - both of which relate external nutrient concentration to the growth rate of phytoplankton - are outlined and compared both mathematically and experimentally, using published data on planktonic diatoms. The Monod model is a direct measurement of the relationship; the variable internal stores model is a two-step process explaining that relationship through an uptake step (described by the Michaelis-Menten equation) and a utilization step (which evaluates the relationship between internal cell quota of a nutrient and the steady-state growth rate). The two models provide comparable information on the dependence of the growth rate on external nutrient concentration. Although the Monod model is not as physiologically sophisticated as the variable internal stores model, it does provide basic kinetic information needed to evaluate growth response to external nutrient concentrations. Uptake kinetics alone cannot be used to predict the outcome of competition between two species, nor does knowledge of the uptake process alone provide sufficient information to evaluate the growth potential of an algal population. Several variables may affect use of kinetic information to interpret field data: temperature, light intensity, day length, clonal variability, and physical mixing processes and sinking. Algal growth rate appears to be controlled by only one nutrient at a time. Use of short-term batch cultures is a satisfactory shortcut for studying nutrient kinetics. (See also W79-03842) (Lynch-Wisconsin)

W79-03875

#### THE VARIABLE CHLOROPHYLL-A FLUORESCENCE AS A MEASURE OF PHOTOSYNTHETIC CAPACITY IN ALGAE,

Oslo Univ. (Norway). Botany Lab.

G. Samuelsson, G. Oquist, and P. Halldal.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mittelungen No. 21, June 1978, p 207-215. 7 fig, 7 ref.

Descriptors: \*Photosynthesis, \*Algae, \*Chlorophyll, \*Fluorescence, \*Primary productivity, \*Analytical techniques, Chlorella pyrenoidosa, Scenedesmus obtusiusculus, Methodology, Measurement, Pigments, DCMU, Herbicides, Research equipment, Carbon radioisotopes, Chlorophyta.

Variable fluorescence is a promising indirect measure of algal primary production and photosynthetic capacity, based on experiments in which the herbicide DCMU was added to cultures of the chlorophytes Chlorella pyrenoidosa and Scenedesmus obtusiusculus to achieve maximum in-vivo chlorophyll-a fluorescence. DCMU inhibits photosynthesis, halts all electron transport, and causes maximum fluorescence. Photosynthesis was measured by a modified carbon-14 fixation method. If the fluorescence method proves satisfactory, the time-consuming Winkler and Carbon-14 methods can be bypassed. Once a sample is collected, a complete fluorescence reading may be performed in less than five minutes, providing information on both chlorophyll content and photosynthetic capacity. Samples may also be stored for several hours in a dark, cold place without affecting accuracy. Two sources of error must be dealt with: (1) the variable component of fluorescence can produce errors of up to 50%, and instruments should be calibrated on the basis of the stable maximum readings obtained through DCMU inhibition; and (2) when chlorophyll extraction is part of the analysis, chlorophyll and its derivatives from inside animals will distort in-vivo fluorescence measurements. The high light level in the commercially available fluorometer used caused excitation above saturation, and to correct this, light intensity was reduced to 20% and exposure increased from one to five seconds. (See also W79-03842) (Lynch-Wisconsin)

W79-03863

#### THE BIOGEOGRAPHY OF HOT SPRINGS ALGAE THROUGH ENRICHMENT CULTURES,

Oregon Univ., Eugene. Dept. of Biology.

For primary bibliographic entry see Field 5C.

W79-03871

#### THE USE OF SELENASTRUM CAPRICORNUTUM BATCH CULTURES IN TOXICITY STUDIES,

Istituto di Ricerca Sulle Acque, Brugherio (Italy). G. Chiadani, and M. Vighi.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mittelungen No. 21, June 1978, p 316-329. 2 fig, 6 tab, 20 ref.

Descriptors: \*Toxicity, \*Heavy metals, \*Selenastrum capricornutum, \*Batch cultures, \*Bottle tests, \*Bioassay, \*Testing procedures, Algae, Phytoplankton, Chlorophyta, Methodology, Italy, Lakes, Water pollution effects, Water pollution control, Culture media, AAP medium, EDTA, Bioindicators.

The Algal Assay Bottle Test of the U.S. Environmental Protection Agency was successfully modified for use with the chlorophyte test alga Selenastrum capricornutum in predicting or assessing heavy metal toxicity in natural waters. Overall conclusions: (1) Selenastrum capricornutum is extremely sensitive to heavy metals and can be considered a good choice for toxicity bioassay. (2) The standard algal assay bottle test with a few modifications can be applied successfully as a reliable screening test for obtaining information on concentrations of various substances likely to be hazardous to phytoplankton. (3) Chemical analysis of complex wastewater or natural waters receiving wastes is often inadequate for predicting toxicity; it is therefore useful to combine chemical analysis with biological tests. (4) Data is needed on the application of the Selenastrum test (especially in natural waters) before it can be widely used as a standard method for toxicity evaluation. Several experiments were performed in this study to: (1) verify Selenastrum sensitivity to heavy metals in a medium without EDTA; (2) assess toxic effect of heavy metals in the normal AAP medium; (3) evaluate use of the standard algal assay to predict potential toxicity of heavy metals in natural waters of different chemical composition, based on bioassays with water samples taken from 22 Italian lakes during spring overturn; and (4) demonstrate usefulness of the Selenastrum test to assess toxicity in natural waters. (See also W79-03842) (Lynch-Wisconsin)

W79-03875

#### THE USE OF NATURAL PHYTOPLANKTON POPULATIONS IN BIOASSAY,

California Univ., Davis. Div. of Environmental Studies.

C. R. Goldman.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mittelungen No. 21, June 1978, p 364-371. 6 fig, 1 tab, 18 ref. NSF-BM 74-DER 76-19524, NSF-RANN GI-22, AEN 74-22675.

Descriptors: \*Phytoplankton, \*Lake Tahoe(CA NV), \*Castle Lake(CA), \*Nitrogen, \*Molybdenum, \*Limiting factors, Natural populations, Testing procedures, California, Lakes, Nutrients, Cycling nutrients, Algae, Fragilaria crotonensis, Phosphorus, Nitrates, Diatoms, Oligotrophy, Chrysophyta, Plant growth, Dinobryon, Microcystis aeruginosa, Chroococcus turgidus, Monosiga, Merismopedia convoluta var. minor, Cyanophyta.

Natural phytoplankton populations from Castle Lake and Lake Tahoe, California, incubated both in-situ and in a continuous-light incubator, were used in experiments on limiting effects of nitrogen. In environments with extremely low nitrogen, as in these lakes, only part-per-billion additions of nutrients are required, and conventional culture technique are not likely to be effective. Adaptation time may be required for enzyme levels to respond to increased substrate levels, and photosynthetic inhibition is frequently the first response measured. In Castle Lake the nitrogen response is complicated by a natural molybdenum deficiency. Culture experiments with natural phytoplankton populations were conducted there to determine the relative availability of nitrogen with and without molybdenum. In early August 1975, five micrograms/l of molybdenum was inhibiting with nitrogen and phosphorus in short supply (three micrograms nitrate/l, no detectable ammonia, and two micrograms/l phosphorus). The combination of nitrate-nitrogen, phosphorus, and molybdenum was most stimulating, followed by nitrogen and phosphorus. By early September nitrogen limitation was very pronounced, and the organisms' ability to utilize nitrate without molybdenum was greatly reduced. In Lake Tahoe experiments, Fragilaria crotonensis, a dominant diatom, showed particular response to nitrate addition in the nitrogen-limiting lake. Various other experiments at the two

## Identification Of Pollutants—Group 5A

lakes are also described. (See also W79-03842). (Lynch-Wisconsin)  
W79-03876

**USE OF LABORATORY CULTURES OF SELENASTRUM, ANABAENA AND THE INDIGENOUS ISOLATE SPHAEROCYSTIS TO PREDICT EFFECTS OF NUTRIENT AND ZINC INTERACTIONS UPON PHYTOPLANKTON GROWTH IN LONG LAKE, WASHINGTON,**  
Corvallis Environmental Research Lab., OR.  
For primary bibliographic entry see Field 5C.  
W79-03877

**THE APPLICATION OF CULTURE METHODS IN STUDIES OF THE ECOLOGY OF SMALL GREEN ALGAE,**

University Coll. of North Wales, Bangor. School of Plant Biology.  
C. M. Happey-Wood.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No. 21, June 1978, p 385-397. 9 fig, 29 ref.

Descriptors: \*Testing procedures, \*Classification, \*Chlorophyta, \*Tetrasporales, \*Phytoplankton, \*Culture media, \*Agar, Cultures, Methodology, Algae, Chlorella, Chlamydomonas, Chlamydomaps bacillus, Phyllocoardium, Stigeoclonium, Priddy Pool(England), Abbot's Pool(England), England, Eutrophication, Ponds, Elodea canadensis, Sphagnum, Epiphytes, Epipelagic algae, Flagellates, Ecology.

A method of identifying and enumerating small, motile chlorophyte algae (especially the little-studied Tetrasporales) involving culture of field samples on agar plates is described as well as application of the method to algal samples from eutrophic Abbot's Pool and shallow, acid Priddy Pool in Somerset, England. Results show that such algae occur frequently in freshwater algal communities, and that distribution, growth patterns, and periodicity vary among species. Ecological studies will be reported in a future paper. Sample of naturally occurring phytoplankton, epipelagic algae, and algae associated with the macrophytes Elodea canadensis and Sphagnum spp. were collected at the two pools, and were incubated on nutrient agar plates (2% concentration) for 14 days. Numbers and types of colonies were counted, and single colonies were isolated and transferred to liquid media for further study and species identification. Genera of small chlorophytes found on the plates included Asterococcus, Carteria, Chlamydomaps, Chlamydomonas, Chlorella, Chlorococcum, Chlorogonium, Glecomonas, Gonium, Kirchneriella, Phyllocoardium, Scourfeldia, Spermatozopsis, Sphaerelopsis, Sphaerocystis, and occasional colonies of the filamentous Stigeoclonium. Nine species are discussed: Chlorella minutissima, C. vulgaris var. Vulgaris, Chlamydomonas perpusilla, Ch. altered, Ch. sphagnophila, Ch. acutata, Chlamydomaps bacillus, Phyllocoardium sp., and Stigeoclonium sp. (See also W79-03842). (Lynch-Wisconsin)  
W79-03880

**THE USE OF SMALL, CONTINUOUS AND MULTISPECIES CULTURES TO INVESTIGATE THE ECOLOGY OF PHYTOPLANKTON IN A SCOTTISH SEA-LOCH,**  
University of Strathclyde, Glasgow (Scotland). Dept. of Applied Microbiology.  
For primary bibliographic entry see Field 5C.  
W79-03879

**THE FERTILITY OF SOME NORWEGIAN INLAND WATERS ASSAYED BY ALGAL CULTURES,**

Norsk Inst. for Vannforskning, Blindern. J. Kotai, T. Krogh, and O. M. Skulberg.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No. 21, June 1978, p 413-436. 17 fig, 7 tab. (See also W79-03842). (Lynch-Wisconsin)  
W79-03878

41 ref.

Descriptors: \*Algal growth potential(AGP), \*Norway, \*Lakes, \*Rivers, \*Eutrophication, \*Bioassay, Selenastrum capricornutum, Algae, Phytoplankton, Chlorophyta, Cultures, Nutrients, Nitrogen, Phosphorus, Plant growth, Lake Mjosa(Norway), Halden watercourse(Norway), Oligotrophy, Water pollution effects.

Some 2000 determinations of algal growth potential (AGP) made in the Ostlandet region of eastern Norway using the chlorophyte Selenastrum capricornutum as the test organism showed that algal growth in naturally oligotrophic inland waters can often be stimulated by small nutrient additions. The fertility of over 400 lakes and rivers in the region (near the Oslofjord) was studied; a selection of the results is presented in tables and figures. Whereas chemical analysis provides data on nutrient concentrations, bioassays are necessary for information on nutrient availability and the capacity of water for sustaining algal growth. Phytoplankton in lakes show seasonal qualitative changes as well as variation in total biomass. In rivers, seasonal variations of AGP are difficult to outline; the annual cycle of plant nutrient abundance is influenced by such external factors as surface drainage and such internal factors as metabolic processes of organisms. The Halden watercourse and Lake Mjosa system are discussed in some detail. In the former, water from oligotrophic-dystrophic Lake Floen flows through the River Holandselv into Lake Bjørkelangen and outward through a chain of lakes. The water receives municipal sewage and agricultural runoff, resulting in considerable eutrophication, especially downstream of Lake Bjørkelangen. Lake Mjosa, increasingly eutrophic due to urbanization, belongs to the group of Norwegian fjord lakes which are fundamentally oligotrophic. Phytoplankton in the lake are dominated by diatoms. (See also W79-03842) (Lynch-Wisconsin)  
W79-03880

**SOME ASPECTS ON THE CLASSIFICATION OF NATURAL WATERS BY ALGAL ASSAYS (SGP), PRELUNE,**

Helsinki Univ. (Finland). Dept. of Limnology.  
P. O. Lehtusluoto.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No. 21, June 1978, p 437-440. 11 ref.

Descriptors: \*Algal growth potential(AGP), \*Trophic level, \*Methodology, \*Classification, \*Lakes, \*Bioassay, Algae, Limnology, Testing procedures, Water bodies, Nutrients, Eutrophication, Organic matter, Salinity, Dry weight, Indicators.

Algal growth potential (AGP), a measure of nutrient conditions, cannot be used as an indicator of trophic status because trophism refers to the amount of organic matter supplied to a water body per unit time. An AGP test made during the period of growth may be inverse to trophic state measures since it reflects remaining nutrient conditions. Trophic status includes functional and dynamic dimensions, which are not accounted for by AGP. AGP was originally intended for use in eutrophication studies for: (1) assessment of a receiving water's nutrient status and sensitivity to change; (2) evaluation of materials and products for potential effects on algal growth in receiving waters; and (3) assessment of changes in waste treatment processes on receiving waters. In measuring AGP, use of algal dry weight as a parameter should either be avoided or done with care because results may be misleading; salinity-dependent errors may also occur. Dry weight measurements appear reliable if algal mass on the filter is over 1.0-1.2 mg dry wt, usually corresponding to a concentration of more than 3-5 mg dry wt/l. Salt concentration may cause an additional dry weight on the filter when algal populations are not dense. Repeated washing of the filter may reduce salt-dependent dry wt by 50-70%, but some will remain. In addition, algal growth is very sensitive to salinity changes. Brackish water algae grow better at higher salinities. (See also W79-03842) (Lynch-Wisconsin)  
W79-03880

Four phytoplankton species were used in dialysis cultures to study effects of four biochemical sewage treatment processes at an experimental plant outside Oslo, Norway. Unialgal (Scenedesmus quadridens, Selenastrum capricornutum, Chlamydomonas reinhardtii, Asterionella formosa), Chlorophyta, Heavy metals, Carbon, Chlorophyll, Nutrients, Limiting factors, Phosphates, Norway, Activated sludge, Biological treatment, Cultures, On-site tests.

W79-03881

**PHOSPHORUS AVAILABILITY IN THREE STREAMS DURING STORM EVENTS: CHEMICAL ANALYSIS VS. ALGAL ASSAY,**  
Kent State Univ., Ohio. Dept. of Biological Sciences.

E. T. Long, and G. D. Cooke.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No. 21, June 1978, p 441-452. 8 fig, 12 ref. US EPA R801936.

Descriptors: \*Bioassay, \*Phosphorus, \*Storm runoff, \*Chemical analysis, \*Available phosphorus, \*Twin Lakes Watershed(OH), \*Streams, \*Urban runoff, Ohio, Algae, Selenastrum capricornutum, Chlorophyta, Methodology, Testing procedures, Eutrophication, Lakes, Nutrients, Soluble reactive phosphorus, Total phosphorus, Bottle test, Forest watersheds, Drainage, Land use, Nutrient budgets, Nutrient loading, Bioavailability, Model studies.

Algal bioassay determined biologically available phosphorus contributed to lakes during storms by three streams in northeast Ohio's Twin Lakes Watershed, one draining an urban area, one a forest, and one a lake. Results were compared with chemical determination of total and soluble reactive phosphorus. Conclusions: (1) Because of storm runoff loading rates should be determined according to hydrological rather than calendar events. (2) Land use greatly affected loading rates; urban areas have greater impact than forests or lake drainage. (3) Available phosphorus differs considerably from total phosphorus loading, both during storms and during base flow. (4) Use of biologically available phosphorus in nutrient budgets might enhance predictability of limnological models relating changes in phosphorus income to degree of eutrophication. Chemical determination of phosphorus includes some forms of phosphorus (designated soluble reactive phosphorus) which are functionally inactive in the lake environment. During base flow, available phosphorus made up only a small fraction of total phosphorus; during storms this fraction increased greatly from the urban and forest areas, but not from the lake discharge. Considerably greater amounts of all three forms of phosphorus were contributed during storm runoff from all three areas studied, but the urban area contributed much more of all three phosphorus forms. (See also W79-03842) (Lynch-Wisconsin)  
W79-03882

**MONITORING THE EFFECTS OF CHEMICAL AND BIOLOGICAL WASTE WATER TREATMENT IN SITU BY DIALYSIS CULTURES OF FRESHWATER ALGAE,**

Bergen Univ. (Norway). Inst. for General Microbiology.

M. Laake.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No. 21, June 1978, p 453-472. 11 fig, 8 tab, 17 ref.

Descriptors: \*Dialysis, \*Analytical techniques, \*Waste water treatment, \*Bioassay, \*Testing procedures, Algae, Phytoplankton, Scenedesmus quadridens, Selenastrum capricornutum, Chlamydomonas reinhardtii, Asterionella formosa, Chlorophyta, Heavy metals, Carbon, Chlorophyll, Nutrients, Limiting factors, Phosphates, Norway, Activated sludge, Biological treatment, Cultures, On-site tests.

Four phytoplankton species were used in dialysis cultures to study effects of four biochemical sewage treatment processes at an experimental plant outside Oslo, Norway. Unialgal (Scenedesmus quadridens, Selenastrum capricornutum, Chlamydomonas reinhardtii, and Asterionella formosa) cultures were inoculated into twelve 32-ml dialysis bags attached to a rotating wheel submerged in flow-through plastic

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification Of Pollutants

boxes exposed to daylight. Growth was measured by optical density at 430 nm. Cells were analyzed for organic carbon, chlorophyll-a and phaeophytin, ATP, and heavy metals (copper, zinc, cadmium, and lead). Types of treated wastewater: (1) secondary Al treatment plus biological oxidation pond (Al + BD); (2) secondary Al treatment (Al); (3) activated sludge biological treatment plus Al (B + Al); and (4) activated sludge with simultaneous Al-treatment (SIM). SIM generally gave the highest cell yield, with the others more or less equal. ATP content per cell was proportional to wastewater load in mixed cultures, but increased with *Scenedesmus* along. Mean levels of 0.6 micrograms ATP/mg C confirm phosphate limitation. Chlorophyll was proportional to load for all treatments. *Scenedesmus* grew better in mixed than in unicellular culture. Algal growth efficiency with phosphate limitation may be ranked as Al + BD, Al, B + Al, and SIM. Heavy metal concentration factors were 1,000,000 for cadmium, 400,000 for lead, and 20,500 for zinc. (See also W79-03842) (Lynch-Wisconsin)  
W79-03883

#### APPLICATION OF ALGAL ASSAYS IN THE ENVIRONMENTAL EVALUATION OF NEW DETERGENT MATERIALS,

Proctor and Gamble Co., Cincinnati, OH. Environmental Safety Dept.

A. G. Payne, and R. H. Hall.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No. 21, June 1978, p 527-546. 2 fig, 14 tab, 23 ref.

Descriptors: \*Detergents, \*Bioassay, \*Trisodium nitrilotriacetate, \*Sodium citrate, \*Sodium aluminosilicate, \*Testing procedures, Algae, Environmental effects, Water pollution effects, Bottle test, Chlorophyta, Cyanophyta, Selenastrum capricornutum, *Microcystis aeruginosa*, *Anabaena flos-aquae*, Methodology, Metals, Trace elements, Toxicity, Nutrients, Plant growth, Pollutants, Algalistic concentrations, Burnside Lake(MN), Lake James(NC), Phosphate substitutes, Proctor and Gamble Company.

Algal assays have been used by the Procter and Gamble Company to evaluate environmental safety of potential detergent materials. EPA's algal assay bottle test has been successfully applied by the company (with modifications) to studies of stimulation, chelation, and toxicity using the chlorophytes *Selenastrum capricornutum*, and the cyanophytes *Microcystis aeruginosa* and *Anabaena flos-aquae*. Algal stimulation studies with trisodium nitrilotriacetate (NTA) and sodium citrate, under consideration as phosphate substitutes, showed no significant effects on algal growth in representative rivers, lakes, and canals in several localities, including Lake James, North Carolina, Lake Erie, and Lake Michigan. Sodium aluminosilicate (SAS), a potential detergent builder, likewise would not be a significant factor in algal stimulation, toxicity, or general nutrition. At Burnside Lake, Minnesota, addition of NTA and SAS under conditions of adequate nitrogen and phosphorus supply resulted in slight increases in algal growth rates, but no increase in maximum standing crops. The bottle test with *M. aeruginosa* was a good technique for trace metal/chelator studies. A toxicity assay procedure using the bottle test is described for determining a test material's algalistic concentration (the level at which there is no net change in algal population.) This criterion is proposed as a less-arbitrary index of algal toxicity than 50% reductions in standing crop (EC50), or growth rate (TL50). (See also W79-03842) (Lynch-Wisconsin)  
W79-03887

#### GROWTH EXPERIMENTS WITH MARINE PLANKTON ALGAE: THE ROLE OF 'WATER QUALITY' IN SPECIES SUCCESSION,

Oslo Univ. (Norway). Dept. of Marine Biology and Limnology.

For primary bibliographic entry see Field 5C.  
W79-03888

#### ALGAL TESTS USED TO STUDY THE CHEMICAL FACTORS REGULATING THE GROWTH OF PLANKTONIC ALGAE IN THE HELSINKI SEA AREA,

Helsinki City Engineer's Office (Finland). Water Conservation Lab.

I. Rinne, and E. Tarkainen.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No. 21, June 1978, p 527-546. 2 fig, 14 tab, 23 ref.

Descriptors: \*Helsinki(Finland), \*Gulf of Finland, \*Phytoplankton, \*Eutrophication, \*Nutrients, \*Trace elements, \*Bioassay, Algae, Chlorella, Chlorophyta, Nodularia, Cyanophyta, Gulfs, Water pollution effects, Sewage disposal, Vantaa River(Finland), Finland, Coasts, Archipelagos, Limiting factors, Nitrogen, Phosphorus, Plant growth, Water chemistry, Rivers, Statistical methods, Testing procedures.

Chemical factors (nitrogen, phosphorus, and seven trace elements) which regulate phytoplankton growth were studied April-October 1973-75 in the Helsinki sea area of the Gulf of Finland by means of algal assays and analysis of water nutrient content. Assays with the chlorophyte *Chlorella* sp. and results of ratio tests showed nitrogen more important than phosphorus in regulating growth; however, phosphorus was in short supply during spring in the very eutrophic bays, and both nutrients were low in less-polluted outer areas during summer. Assays with *Nodularia* sp. showed that phosphorus was the growth-limiting factor for this nitrogen-fixing blue-green alga, especially in spring and early summer. The waste load discharged to the increasingly eutrophic area consists primarily of untreated municipal sewage from Helsinki and Espoo (about 450-500 tons phosphorus and 2400-2600 tons nitrogen/yr), and polluted water discharged by the Vantaa River (about 100 tons P and 1500 tons N/yr). Salinity variations of 3-6% in summer do not affect growth of *Chlorella*. Inner bays (over 100 mg C sub ass./cu m/day) and the inner archipelago (200-1000 mg) are eutrophic, and the outer archipelago is fairly clean (< 200 mg); each area was sampled. Samples were enriched with nitrogen, phosphorus, and trace amounts of boron, manganese, zinc, cobalt, copper, molybdenum, and iron in various combinations. (See also W79-03842) (Lynch-Wisconsin)  
W79-03889

#### RELATIONSHIP BETWEEN ALGAL PHOSPHORUS EXTRACTION AND WATER PHOSPHORUS CONCENTRATION,

FMC Corp., Princeton, NJ. Research and Development Center.

For primary bibliographic entry see Field 5C.  
W79-03890

#### SORPTION AND CONCENTRATION OF TOXIC MINERALS BY MASS CULTURES OF CHLOROCOCCALES,

Gesellschaft fuer Strahlen- und Umweltforschung mb.H., Dortmund (Germany, F.R.).

For primary bibliographic entry see Field 5C.  
W79-03892

#### COHO SALMON (ONCORHYNCHUS KISUTCH) AND HERRING GULLS (LARUS ARGENTATUS) AS INDICATORS OF ORGAN-CHLOROCARBOCALES CONTAMINATION IN LAKE ONTARIO,

Canadian Wildlife Service, Ottawa (Ontario). Wildlife Toxicology Div.

R. J. Norstrom, D. J. Hallett, and R. A.

Sonstegard.

Journal of the Fisheries Research Board of Canada, Vol. 35, p. 1401-1409, 1978. 1 fig, 5 tab, 25 ref.

Descriptors: \*Bioindicators, \*Chlorinated hydrocarbon pesticides, \*Coho salmon, \*Gulls, \*Pesticide residues, Insecticides, Polychlorinated biphenyls, DDE, DDD, Dieldrin, Great Lakes, Lake

Ontario, Smelt, \*Mirex, \*Tissue analysis, \*Bioaccumulation, Pollutant identification, Alewives.

Coho salmon and herring gulls in the Great Lakes depend to a large extent on alewives and smelt for their food. All of these species range widely in the lakes, and therefore provide an integrated measure of levels of organochlorine contaminants in the lakes. Organochlorine residues were determined in herring gull eggs from four eastern Lake Ontario colonies, coho salmon from western Lake Ontario, and pooled alewife and smelt from the stomach contents of the salmon. The mean apparent bioconcentration factor was 2.9 + or - 0.7 for accumulation of PCBs, DDE, mirex, photomirex, HCB, dieldrin, and DDD. The bioconcentration factor was 50 + or - 10 for accumulation of PCBs with more than five chlorines, DDE, mirex, and photomirex in herring gull eggs. PCBs with fewer than six chlorines, HCB, dieldrin, and DDD were concentrated concentrated to a lesser extent in herring gull eggs. Assuming an apparent bioconcentration factor from water of  $5 \times 10^6$  for accumulation of PCBs, DDE, mirex, and photomirex in smelt and alewives, the corresponding values in coho salmon and herring gull eggs were  $1.5 \times 10^6$  and  $2.5 \times 10^6$ . (EIS-Deal)  
W79-03895

#### LYSOSOMAL RESPONSES TO EXPERIMENTALLY INJECTED ANTHRACENE IN THE DIGESTIVE CELLS OF MYtilus EDULIS,

Institute for Marine Environmental Research, Plymouth (England).

For primary bibliographic entry see Field 5C.  
W79-03900

#### 237PU EXPERIMENTS WITH THE PLAICE PLEURONECTES PLATESSA,

Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Radiobiological Lab.

For primary bibliographic entry see Field 5C.  
W79-03901

#### PROCEEDINGS OF THE FIRST AND SECOND USA-USSR SYMPOSIA ON THE EFFECTS OF POLLUTANTS UPON AQUATIC ECOSYSTEMS-VOLUME I: DULUTH, MINNESOTA, USA SYMPOSIUM OCTOBER 21-23, 1975, VOLUME II: BOROK, JAROSLAVL OBLAST, USSR SYMPOSIUM JUNE 22-26, 1976,

Environmental Protection Agency, Grosse Ile, MI. For primary bibliographic entry see Field 5C.  
W79-03906

#### CHARACTERISTICS OF THE MOSCOW RIVER WATER QUALITY ACCORDING TO HYDROBIOLOGICAL INDICES,

V. A. Abakumov, and G. L. Margolina.

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol 1, Environmental Protection Agency, Report EPA-600/3-78-076, p 32-35, 1978.

Descriptors: \*Water quality, \*Aquatic populations, Moscow River, USSR, Water quality control, Bacterioplankton, Phytoplankton, Zooplankton, Benthic fauna, Microorganisms, Plant populations, Primary productivity, Trophic level, Water treatment, Waste treatment, Hydrobiology, W P effects, \*Species diversity, \*Hydrobiological indices, Biological indicators.

In order to obtain hydrobiological indices characterizing the water quality of the Moscow River, the qualitative and quantitative composition of bacterioplankton, phytoplankton, zooplankton, zoobenthos, and higher water plants were studied. The authors concluded that it was essential to apply a combination of water quality control methods according to hydrobiological indices which provide information not only on water pollution, but also on the state of aquatic organisms in water bodies. (See also W79-03906) (EIS-Deal)  
W79-03909

Identification Of Pollutants—Group 5A

**ENDPOINTS IN BIOASSAY,**

L. L. Smith, Jr.

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. I, Environmental Protection Agency, Report EPA-600/3-78-076, p 36-36, 1978. 5 fig, 3 tab, 8 ref.

**Descriptors:** \*Bioassay, \*Toxicity, \*Analytical techniques, \*Chemical properties, Methodology, Lethal limit, Biochemistry, Enzymes, Growth stages, Chemical analysis, Reproduction, Mortality, Fecundity, Fertility, Growth rates, Animal physiology, Animal metabolism, Fish physiology, Laboratory tests, \*Toxicity testing.

The purpose of this discussion was to elaborate on means of defining meaningful endpoints and interpreting the resultant findings. It was recommended that (1) the most sensitive stage be used where possible as the basis for acute median tolerance limit tests; (2) temperature used for tests should approximate the natural conditions to which the fish will be subjected during critical periods in the outdoor environment; (3) median tolerance limit value should be based on the time at which an asymptote is reached in the decline of the toxicity curve; (4) where possible, reproductive behavior and success be used as the final criterion of the proper endpoint used to determine safe concentration of toxicants or effluents; and (5) uniform application factors not be used over a broad spectrum of species or toxicants without definitive chronic tests. (See also W79-03906) (EIS-Deal) W79-03913

**PHYSIOLOGICAL-BIOCHEMICAL ASPECTS OF WATER TOXICOLOGY,**

Tsentralny Nauchno-Issledovatel'skii Inst. Osetrovoi Khozyaistva, Astrakhan (USSR).

V. I. Lykyanenko.

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. I, Environmental Protection Agency, Report EPA-600/3-78-076, p 47-54, 1978. 31 ref.

**Descriptors:** \*Fish physiology, \*Water quality standards, \*Toxicity, \*Chemical analysis, Fish diseases, Phenols, Organic compounds, Chemical properties, Water quality, Water chemistry, Water analysis, Effluents, Chemical wastes, Industrial wastes, Pesticide residues, Heavy metals, Public health, Bioassay, Biochemistry, \*Tissue analysis.

During the early decades of this century basic standards for maximum permissible concentrations of harmful substances discharged into water bodies were introduced in many countries. The dominant role in establishing these standards belonged to medical specialists. However, in more recent years it was learned that levels of many substances which fully satisfy the health specialists do not guarantee the purity of water bodies from a general biological or fishing industry point of view. The author traces the development of knowledge in the area of fish biochemistry and physiology and how these advances have influenced standards for water quality. (See also W79-03906) (EIS-Deal) W79-03911

**MONITORING THE CONDITION OF FLOWING WATERS BY BIOLOGICAL ORGANISMS,**

R. Patrick.

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. I, Environmental Protection Agency, Report EPA-600/3-78-076, p 68-81, 1978. 6 fig, 1 tab, 8 ref.

**Descriptors:** \*Bioindicators, \*Oysters, \*Diatoms, \*Monitoring, Biological communities, Diptera, Heavy metals, Cytological studies Chemical analysis, Water chemistry, Water quality, Sampling, Biomass, Eutrophication, \*Tissue analysis, \*Bioaccumulation.

It is evident that the monitoring of biological organisms can be very valuable in determining the effects of wastes. As contrasted with chemical and

physical determinations of water quality, the organisms integrate over time all deleterious effects, whereas a chemical examination only determine the presence of the chemical for which analysis is made at the particular time. The biological studies often give an indication of a certain type of chemical or deleterious conditions being present. It is then necessary to determine exactly what chemical is causing the effect. Therefore, both types of studies become important, but the biological studies are the better continual monitoring studies if only one type of monitoring is to be made, because it integrates all changes which may occur. (See also W79-03906) (EIS-Deal) W79-03913

**DETERMINING THRESHOLD AND BIOLOGICALLY DANGEROUS CONCENTRATIONS OF BLUE-GREEN ALGAE IN WATER BODIES,**

Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.

For primary bibliographic entry see Field 5C. W79-03916

**TOXIC ORGANIC RESIDUES IN FISH,**  
Michigan State Univ., East Lansing.

H. E. Johnson.

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. I, Environmental Protection Agency, Report EPA-600/3-78-076, p 115-120, 1978. 18 ref.

**Descriptors:** \*Chemical wastes, \*Industrial wastes, Organic compounds, Polychlorinated biphenyls, DDT, Toxicity, Fish physiology, Animal metabolism, Path of pollutants, Pesticide residues, Trophic level, Public health, Dieldrin, \*Tissue analysis, \*Bioaccumulation.

The development of sophisticated analytical techniques and intensified chemical monitoring efforts has shown that a wide variety of synthetic organic chemicals or their degradation products are present in the aquatic environment. One example is the detailed analysis of PCBs in fish from the Great Lakes. It is imperative that we develop a systematic approach for evaluation of new materials and new technology. Important new efforts are being made to find correlations between chemical structure and biological activity. A chemical classification system based on physical properties, chemical structure, and biological activity would provide some indication of potential hazard. Simple model ecosystems and food-chain models offer additional promise for preliminary testing to identify harmful properties of chemicals. (See also W79-03906) (EIS-Deal) W79-03917

**REGISTRATION OF PESTICIDES: CONSIDERATIONS IN CONDUCTING AQUATIC TOXICITY TESTS,**

R. A. Schoettger.

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. I, Environmental Protection Agency, Report EPA-600/3-78-076, p 166-180, 1978. 5 fig, 17 ref.

**Descriptors:** \*Pesticides, \*Pesticide toxicity, \*Bioassay, Legislation, Regulation, Chemical properties, Chemical analysis, Fish food organisms, Toxicity, Absorption, Growth rates, Fish physiology, Lampreys, Pesticide kinetics, Water pollution effects, \*Teratogens, \*Toxaphene, \*TFM, \*Lampricides.

Requirements for registration, re-registration, and classification of pesticides for general or restricted use were published recently by the EPA. If the pesticide is intended for outdoor uses, data must generally be submitted that permit evaluation of hazards to non-target animals, including fish and wildlife. Depth of these evaluations depends on proposed patterns of use, environmental chemistry characteristics, and nature of the hazard to humans, domestic animals, and non-target animals. Data to support registration can be obtained from

acute and chronic or partial chronic toxicity studies, simulated field tests, or field monitoring and observation, as described in the extensive registration guidelines recently proposed by EPA. Chronic testing techniques and apparatus, with controllable light and temperature, offer versatile systems for investigating effects of pesticides and other contaminants on fish according to daily and seasonal periodicity and simulated pesticide-use patterns. (See also W79-03906) (EIS-Deal) W79-03922

**TOXICITY TESTS IN THE REGULATION OF WASTE DISCHARGES IN THE UNITED STATES,**

P. Doudoroff.

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. II, Environmental Protection Agency, Report EPA-600/3-78-076, p 1-7, 1978. 9 ref.

**Descriptors:** \*Toxicity, \*Mortality, Bioassay, Waste treatment, Waste disposal, \*Monitoring, Standards, Regulation, California, Laboratory tests, Toxic wastes, Application factors, Toxicity emission rate, Methodology.

There is a trend in the United States to require the regular biological testing of waste waters to verify compliance with, or to detect violations of, some specific regulatory requirements limiting discharge of toxic wastes. The philosophies that are used to develop the regulations regarding the disposal of toxic wastes are examined. (See also W79-03906) (EIS-Katz) W79-03926

**TOXICOLOGICAL CONTROL OF POLLUTION OF FRESHWATERS,**

Moscow State Univ. (USSR). Faculty of Biology.

N. S. Stroganov.

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. II, Environmental Protection Agency, Report EPA-600/3-78-076, p 8-10, 1978.

**Descriptors:** \*Toxicity, \*Bioassay, \*Methodology, Standards, Water pollution effects, Domestic wastes, Industrial wastes, Laboratory tests, Toxicity control, \*Monitoring, Degree of toxicity, Waste dilution, Waste water(Pollution), Waste disposal, Fresh water.

To control the quality of waste discharges in order to maintain the suitability of water for aquatic organisms, the toxicity of the wastes should be measured. The toxicity of waste waters should be determined. The toxicity of these wastes and associated hazards to aquatic organisms should be determined. (See also W79-03906) (EIS-Katz) W79-03927

**TOXICITY OF EXPERIMENTAL FOREST INSECTICIDES TO FISH AND AQUATIC INVERTEBRATES,**

R. A. Schoettger, and W. L. Mauck.

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. II, Environmental Protection Agency, Report EPA-600/3-78-076, p 11-27, 1978. 5 fig, 19 ref.

**Descriptors:** \*Bioassays, \*Toxicity, \*Methodology, Laboratory tests, Freshwater fish, Benthos, Brook trout, Atlantic salmon, Sumithion, Carbaryl, Dylox, Matacil, Dimilin, Orthene, Pesticides, Insecticides, Carbamate Pesticides, Organic phosphate insecticides, Acute toxicity.

Aerial Application of six potential DDT substitute forest insecticides, with the exception of the field formulation of Matacil, should not have a major toxic effect on brook trout and Atlantic salmon. Insecticides are Sumithion, carbaryl, Dylox, Matacil, Dimilin ad Orthene. These insecticides may kill aquatic invertebrates. (See also W79-03906) (EIS-Katz)

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification Of Pollutants

W79-03928

**MICROBIOLOGICAL INDICES OF THE QUALITY OF WATER AND METHODS OF THEIR DETERMINATION,**  
Akademiya Nauk SSSR, Moscow. Inst. Biologii Vnutrennykh Vod.  
V. I. Romanenko.

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. II, Environmental Protection Agency, Report EPA-600/3-78-076, p. 55-74, 1978. 5 fig., 4 tab., 28 ref.

Descriptors: \*Microbiology, \*Bacteria, Water quality, \*Methodology, Laboratory tests, Laboratory equipment, Aquatic bacteria, Bioindicators, Number of bacteria, Oxygen demand, Oxygen requirements, Monitoring.

Microbiological indices in some cases are the best way to characterize the quality of water used for both drinking and industrial purposes. Microorganisms are excellent indicators which often exceed the sensitivity of chemical and physical methods. Methods of using microorganisms to determine water quality are demonstrated. (See also W79-03906) (EIS-Katz)  
W79-03931

**A RESEARCH SYSTEM FOR DEVELOPING FISHERIES STANDARDS FOR WATER QUALITY, CONSIDERING THE PECULIARITIES OF TRANSFERRING EXPERIMENTAL DATA TO NATURAL WATER BODIES,**  
For primary bibliographic entry see Field 5G.  
W79-03933

**EXPERIMENTAL TESTING OF TOXICITY OF WATER MEDIA AND INCREASING OF THE SENSITIVITY OF BIOLOGICAL TESTS,**  
L. P. Braginski, V. D. Bers, T. I. Birger, I. L. Burtinaya, and F. Ya. komarovski.  
In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. II, Environmental Protection Agency, Report EPA-600/3-78-076, p. 102-112, 1978. 5 tab., 29 ref.

Descriptors: \*Methodology, \*Bioassay, \*Toxicity, Mortality, Laboratory tests, Laboratory animals, Phytoplankton, Algae, Daphnia, Amphipoda, Fresh water fish, USSR, Mollusca, Monitoring.

The toxicity bioassay tests used in the USSR to determine water quality are examined. Organisms used are algae, Daphnia, amphipods, molluscs, and several species of fresh water fish. (See also W79-03906) (EIS-Katz)  
W79-03935

**EXPERIMENTAL APPLICATION OF VARIOUS SYSTEMS OF BIOLOGICAL INDICATION OF WATER POLLUTION,**  
G. G. Winberg.

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. II, Environmental Protection Agency, Report EPA-600/3-78-076, p. 141-149, 1978. 2 fig., 9 ref.

Descriptors: \*Water pollution effects, \*On-site investigations, \*Methodology, USSR, Benthos, Environmental effects, Aquatic populations, Aquatic productivity, Polluted waters, Oligochaetes, Biotic index, Diversity index, Indicator organisms, Aquatic insects, Zooplankton, \*Bioindicators.

Studies are being made in the USSR on the evaluations of the various methods of biological analysis of water pollution. Comparative evaluation of the various systems of hydrobiological analysis of polluted waters has been made by the staff of the Laboratory of Freshwater and Experimental Hydrobiology of the Zoological Institute of the USSR Academy of Sciences. (See also W79-03906) (EIS-Katz)  
W79-03939

### STRUCTURAL AND FUNCTIONAL CHARACTERISTICS OF SESTON AS INDICES OF WATER POLLUTION,

A. P. Ostapenya.

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. II, Environmental Protection Agency, Report EPA-600/3-78-076, p. 150-157, 1978. 5 fig., 1 tab.

Descriptors: \*Seston, \*Methodology, \*Plankton, Phytoplankton, \*Water pollution effects, Chlorophyll, USSR, Oxygen demand, Photosynthesis, Primary production, Trophic level, On-site investigation, Index of pollution, Bioindicators, Dissolved oxygen, Aquatic ecosystems, Aquatic populations.

Plankton has long been a traditional part of ecological investigations related to water pollution. Accumulated data show convincingly that seston, including planktonic, detrital and mineral suspensions are an important, distinct structural component of aquatic ecosystems, functioning as a single entity. Seston actively influences the quality of water. This influence is diverse, and is evident by its action on the production and destruction stages of the biotic circulation. Structural and functional characteristics of the seston are sufficiently sensitive for use as an indicator in the evaluation of water pollution. (See also W79-03906) (EIS-Katz)  
W79-03940

### VOLATILE LOSSES OF NITROGEN FROM SOIL,

California Univ., Davis. Dept. of Land, Air and Water Resources.

For primary bibliographic entry see Field 3F.  
W79-03947

### X-RAY ANALYSIS OF AIRBORNE ASBESTOS, DESIGN AND CONSTRUCTION OF A PROTOTYPE ASBESTOS ANALYZER,

Naval Research Lab., Washington, DC. Radiation Technology Div.

L. S. Birks, J. V. Gilfrich, and J. W. Sandelin.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 512. Price codes: A03 in paper copy, A01 in microfiche. Final Report No. EPA-600/2-78-194, August 1978. 23 p., 9 fig., 1 tab., 3 ref. Interagency Agreement EPA-IAG-D-0651.

Descriptors: \*Asbestos, \*Air pollution, \*X-ray diffraction, \*Spectroscopy, Analytical techniques, Instrumentation, Prototypes, Measurement, Clays, Mineralogy, Analysis, Prototype tests.

The design and construction of the working prototype asbestos analyzer is described. The analyzer incorporates the principle of broad-beam x-ray optics and a special fiber-aligned sample. Two detectors are used for simultaneous measurement of diffracted signal and background. The prototype analyzer allows fibrous asbestos to be distinguished from nonfibrous forms or clay minerals of similar character, and relies on sample preparation where the asbestos fibers are oriented on a special grid. The x-ray optics allow specific 20 diffraction angles to be selected for large-area specimen deposits. Sub-microgram amounts of asbestos can be detected and quantitatively measured. The analyzer is contained in a 15 x 15 x 32 cm vacuum box and is mounted on top of a standard commercial x-ray supply. The Cr target spectrographic tube is located in a separate lead-shielded enclosure in the box. The beam trap, a critical component, reduces the backscattered noise signal to less than 100 photons/sec from an incident beam of 10 to the eleventh power photons/sec. (Davison-IPA)  
W79-03967

### EVALUATING THE SAMPLING FREQUENCIES OF WATER QUALITY MONITORING NETWORKS,

Colorado State Univ., Fort Collins. Dept. of Agriculture and Chemical Engineering.

For primary bibliographic entry see Field 5C.  
W79-03976

### RESULTS OF RESEARCH RELATED TO STRATOSPHERIC OZONE PROTECTION, REPORT TO CONGRESS,

SRI International, Menlo Park, CA.

R. E. Ruff, P. B. Russell, S. D. Kaplan, B. R. Holt, and J. W. Ryan.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-284 400. Price codes: A03 in paper copy, A01 in microfiche. Report No. EPA-600/8-78-002, January 1978. First biennial report to Congress required by Section 153(g), PL 95-95. 50 p., 6 fig., 5 tab., 23 ref. 68-01-3939.

Descriptors: \*Ultraviolet radiation, Aquatic life, \*Plant growth, \*Skin cancer, \*Clean Air Act, \*Ozone-depletion, Human diseases, Crustaceans, Social impact, Economic impact, Spectroradiometry, \*Air pollution effects.

The results of research conducted under Section 153 of Public Law 95-95 by the Environmental Protection Agency (EPA), and the results of related research and studies conducted by other Federal agencies is reported. Research on ozone protection has been coordinated under a Biological and Climatic Effects Research (BACER) Program, a multiagency, multidisciplinary effort originally funded by EPA. Its purpose is to reduce uncertainties regarding ozone-depletion to quantify ozone-depletion impacts wherever possible. The effects resulting from the release of ozone-depleting substances have been shown to impact on biological system and climate, which in turn have social and economic impacts. Activities include surveys of skin cancer among populations at different latitudes, measurements of Ultraviolet B (UV-B) radiation, tests of over 100 plant species under simulated and natural UV-B levels, experiments with aquatic ecosystems, and social economic workshops. Study results indicate: skin cancer incidence is related to UV-B exposure; all plants are sensitive to UV-B at some exposure level, resulting in stunting, bleaching or discolored leaves; and UV-B damages the larvae of shrimp, crab, mackerel, and anchovy. New UV-B monitoring devices developed include the Norris spectroradiometer for biological effects research and a submersible spectroradiometer for aquatic use. Future long term and short term research needs are discussed. (Davison-IPA)  
W79-03977

### A RAPID METHOD FOR ESTIMATING LOG P FOR ORGANIC CHEMICALS,

Environmental Research Lab., Duluth, MN.

G. D. Veith, and R. T. Morris.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-284 386. Price codes: A03 in paper copy, A01 in microfiche. Report No. EPA-600/3-78-049, May 1978. 24 p., 2 fig., 3 tab., 8 ref.

Descriptors: \*Pollutant identification, \*Chemical analysis, \*Chromatography, \*Organic chemicals, Logarithms, Equations, Laboratory equipment, Mathematics, Ultraviolet detectors, Laboratory tests, Time, Economics.

A study, using a variety of industrial chemicals, was conducted to determine if Log P and the high pressure liquid chromatography (HPLC) reverse phase retention time are related, and to develop an inexpensive method requiring less than an hour for estimating Log P by using HPLC. The technique developed estimates the n-octanol/water partition of organic chemicals. The system consisted of preparative Micro-Pak (R) C-10 reverse phase column eluted isocratically with a 15% water/85% methanol solvent pumped through the column at 2.0 ml/min at 1,200 psi. The chemicals were first dissolved in a mixture of acetone and cyclohexane, then detected in the eluent with 254-nm ultraviolet detector; a fraction collector was used for chemicals that cannot be detected by the ultraviolet detector. The fractions were analyzed to determine the retention time of the chemical. The log of the retention time (LogRT) of organic chemicals on a permanently bonded reverse-phase HPLC system is linearly related to the log of the n-octanol/water partition coefficient (Log P):  $P = 5.106 \log RT$ .

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## Identification Of Pollutants—Group 5A

1.258 with a correlation coefficient 0.975. By using a calibration mixture, the Log P of other organic chemicals were estimated with a mean accuracy of 22.8%. This technique permits estimation of Log P in a maximum of 25 minutes, and does not require a knowledge of the chemical structure for the estimate. (Davison-IPA)  
W79-03978

**MANUAL FOR THE INTERIM CERTIFICATION OF LABORATORIES INVOLVED IN ANALYZING PUBLIC DRINKING WATER SUPPLIES — CRITERIA AND PROCEDURES**, Environmental Protection Agency, Washington, DC.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 118, Price codes: A05 in paper copy, A01 in microfiche. Report No. EPA 600/8-78-008, May 1978. 100 p, 5 tab.

**Descriptors:** \*Laboratory certification, \*Water Quality Act, Potable water, \*Inspection, Water quality, Water analysis, Radiochemical analysis, Microbiology, Quality control, Water quality standards, Publications.

Evaluation procedures and minimum technical requirements recommended for interim certification of laboratories analyzing public drinking water supplies are described; optional certification requirements have been included. The manner in which the Environmental Protection Agency (EPA) will carry out a program for interim approval and certification of its 10 regional laboratories and principal state laboratories is described. Formal certification of a laboratory under regulatory authority is the preferred approach of a certification program. However, a phased approach has been selected because the interim regulations are already in effect. Interim approval will be granted to laboratories on an administrative basis in phase one to provide acceptable data for immediate implementation of the Interim Primary Regulations. After an on-site evaluation based on the contents of this manual, Interim Certification will be granted. The emphasis of this phase is to provide advice and technical requirements and optional requirements for conducting on-site evaluations of chemical, microbiological and radiological laboratories are set forth. (Davison-IPA)  
W79-03979

**SAMPLING AND ANALYSIS RESEARCH PROGRAM AT THE PARAHO SHALE OIL DEMONSTRATION**,

TRW Environmental Engineering Div., Redondo Beach, CA.

J. E. Cotter, C. H. Prien, J. J. Schmidt-Collerus, D. J. Powell, and R. Sung.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-284 027, Price codes: A03 in paper copy, A01 in microfiche. Final Report No. EPA-600/7-78-065, April 1978. 80 p, 21 fig, 18 tab, 6 ref, 3 append. 68-02-1881.

**Descriptors:** \*Pollutant identification, \*Oil shales, \*Liquid wastes, \*Sampling, \*Prototype tests, Chemical analyses, Chemical wastes, Laboratory tests, Analytical techniques, Chromatography, Mass spectrometry, Anvil Points, \*Colorado.

A study of the eight oil shale retorting processes at the Paraho oil shale demonstration site at Anvil Points, Colorado, was undertaken to establish characteristics common to the processes to develop prototype sampling and analytical procedures for shale oil recovery operations. The Anvil Points operations includes two vertical retorts, a larger semi-works unit and a smaller pilot plant. The test plan included both retorts because their process streams are essentially different. Sample locations were determined by the need for information on process streams relative to emissions and effluents expected in a full scale plant. Samples taken included: the recycle gases, hydrogen sulfide, sulfur dioxide, oxides of nitrogen, ammonia and arsenic; recycle condensate; process water; processed shale discharged from the retorts; and dust from the vicinity of the crushing and screening equipment. The

various laboratory analyses included: wet chemical analysis, spark source mass spectrometry, high pressure liquid chromatography, thin layer chromatography, gel permeation chromatography, and gas chromatography/mass spectrometry (GC/MS). Condensate water inorganic analyses were done for calcium, magnesium, sodium and potassium salts, ammonia, gross parameters, and trace elements. Condensate and water samples were analyzed for organic neutrals, organic acids, and organic bases. Data obtained from the crushing and retorting operations are unique to the Paraho demonstration because much of the equipment and many of the operating procedures are not employed in a commercial venture. (Davison-IPA)  
W79-03980

**THE MULTIELEMENTAL ANALYSIS OF DRINKING WATER USING PROTON-INDUCED X-RAY EMISSION (PIXE)**,

Purdue Research Foundation, Lafayette, IN.  
P. C. Simms and F. A. Rickey.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 832, Price codes: A04 in paper copy, A01 in microfiche. Final Report No. EPA-600/1-78-058, September 1978. 58 p, 7 fig, 9 tab, 6 ref. 68-03-2178.

**Descriptors:** Pollutant identification, \*Water analysis, \*Chemical analysis, \*Potable water, \*Nuclear acceleration, \*Water properties, X-ray analysis, Data processing, X-ray fluorescence, Vapor separation techniques, Filtration, Trace elements, Laboratory tests, Proton-induced x-ray emission, Spectroscopy, Water supply, Atomic absorption.

The use of energetic protons from a nuclear accelerator to perform quantitative, multi elemental analysis of drinking water is described. Before Proton Induced X-ray Emission (PIXE) could be used for aqueous samples, 'vapor filtration', a new method for depositing the elements on a backing suitable for proton bombardment, was developed. When a sample is bombarded with protons, characteristic x-rays emitted from each element can be used in identifying the element in the sample. The x-rays are detected by an energy sensitive semiconductor device, and the data are processed by an on line computer. A total of 76 elements heavier than aluminum were identified from 6200 samples. Atomic absorption was used for sodium analysis. Excellent detection limits (0.1 to 100 ppb) were obtained for most elements heavier than silicon. Cost per sample in this project was \$42.60, but with improvements to this particular accelerator, quality analyses for 20,000 samples per year could be provided at an approximate cost reduction of 50% per sample. (Davison-IPA)  
W79-03981

**ARSENIC DETERMINATION BY THE SILVER DIETHYLDITHIOCARBAMATE METHOD AND THE ELIMINATION OF METAL ION INTERFERENCE**,

Claflin Coll., Orangeburg, SC.

S. S. Sandhu.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 153, Price codes: A03 in paper copy, A01 in microfiche. Report No. EPA-600/4-78-038, July 1978. 36 p, 7 fig, 5 tab, 22 ref. R 804164-01.

**Descriptors:** \*Pollutant identification, \*Water analysis, \*Laboratory tests, \*Chemical interference, \*Arsenic, \*Ions, Color reactions, Chemical analysis, Potable water, Waste water, Organic compounds, Trace metals, Inorganic compounds, Anion exchange, Water quality, Water chemistry, Distillation.

Data resolving the confusion surrounding the extent of ion interference in the determination of arsenic in water and waste water using the silver diethyldithiocarbamate (SDDC) method is presented. The standard procedure, with minor variations, was used for this study. Micro amounts of arsenic were recovered in the presence of the interfering ions, chromium (IV), cobalt (II), copper (II), molybdenum (VI), and nickel (II). The metal ions did not appear to interfere in the generation of arsine

for concentrations of 5.0 mgL<sup>-1</sup> and under. A significant positive interference in arsenic-SDDC color development and measurements was shown by antimony (III) concentrations of 0.3 mgL<sup>-1</sup> or above, and mercury (II) concentrations of 1.5 mgL<sup>-1</sup> or above. Organically bonded arsenic was successfully released by the potassium permanganate digestion method before its determination by SDDC. It was found that the distillation method was unsatisfactory for concentrating and isolating arsenic from interfering ions in synthetic dilute aqueous solutions and natural water before determination by SDDC. The anion exchange method was effective for eliminating the interfering ions, but arsenic recovery decreased in the presence of high concentrations of antimony in polluted water. However, recovery was improved by an increase in the amount of resin used in the chromatographic column. (Davison-IPA)  
W79-03982

**A CASE STUDY OF HAZARDOUS WASTES IN CLASS I LANDFILLS**,

Southern California Univ., Los Angeles. Environmental Engineering Program.  
For primary bibliographic entry see Field 5B.  
W79-03984

**PROCEEDINGS OF THE SECOND WORKSHOP ON SAMPLING GEOTHERMAL EFFLUENTS**,

Report No. EPA-600/7-78-121, June 1978. Workshop held in Las Vegas, Nevada, February 15-17, 1977. 256 p, 79 fig, 22 tab, 98 ref. 68-03-2468.

**Descriptors:** \*Geothermal studies, \*Analytical techniques, \*Effluents, \*Sampling, \*Geochemistry, Pollutants, Monitoring, Standards, Water analysis, Soil analysis, Methodology, \*Conferences, Publications, Abstracts, Information exchange.

A compilation of 17 papers, and abstracts of 14 others, presented at the second in a series of workshops on sampling and analysis of geothermal effluents is provided. The purpose of the workshop was to continue the exchange of ideas and knowledge introduced at the first workshop held in October 1975. It is intended that an acceptable set of standard geothermal effluent and analysis methods will eventually be developed from this series of workshops. Papers presented cover techniques and devices for sampling and measuring gases, soils, and water associated with geothermal areas, interpretation of results of sampling, and data from various specific areas. (Davison-IPA)  
W79-03987

**INORGANIC SPECIES IN WATER: ECOLOGICAL SIGNIFICANCE AND ANALYTICAL NEEDS, A LITERATURE REVIEW**,

Environmental Research Lab., Athens, GA.  
For primary bibliographic entry see Field 5C.  
W79-03992

**MERCURY, LEAD, ARSENIC, AND CADMIUM IN BIOLOGICAL TISSUE. THE NEED FOR ADEQUATE STANDARD REFERENCE MATERIALS**,

Environmental Monitoring and Support Lab., Las Vegas, NV.

W. F. Beckett.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 198, Price codes: A04 in paper copy, A01 in microfiche. U.S. Environmental Protection Agency, EPA-600/4-78-051, 68 p, August 1978. 2 fig, 12 tab, 1 app, 221 ref.

**Descriptors:** \*Mercury, \*Lead, \*Cadmium, \*Arsenic compounds, Toxicity, Mortality, Analytical techniques, Chemical analysis, Path of pollutants, Heavy metals, Plant physiology, Animal physiology, Fish physiology, \*Arsenic, \*Bioaccumulation, \*Tissue analysis, \*Carcinogens, \*Mutagens, Reference standards.

The present situation of standard reference materials consisting of plant and animal tissues is exam-

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification Of Pollutants

ined. A brief literature review presents a cross-section of published data on the incorporation of mercury, lead, arsenic, and cadmium into plant and animal tissues. It points out the wide concentration ranges of these elements that are encountered in biological tissue samples under environmental and experimental conditions. These concentration ranges are compared with the individual values of the corresponding elements as determined for the biological standard reference materials presently available from the National Bureau of Standards. The conclusion is reached that there is a need for the preparation of additional biological reference materials encompassing wide concentration ranges of the elements of interest. (EIS-Deal)  
W79-0395

**THE SELENASTRUM CAPRICORNUTUM PRINTZ ALGAL ASSAY BOTTLE TEST EXPERIMENTAL DESIGN, APPLICATION, AND DATA INTERPRETATION PROTOCOL,**  
Corvallis Environmental Research Lab., OR.  
W. E. Miller, J. C. Greene, and T. Shirovaya.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 950. Price codes: A07 in paper copy, A01 in microfiche. Report EPA 600/9-78-018, July 1978, 126 p, 21 fig, 12 tab, 184 ref.

Descriptors: \*Algae, \*Nutrients, \*Methodology, \*Laboratory tests, Metals, Toxicity, \*Eutrophication, Laboratory equipment, Nitrogen, Phosphorus, Algal control, Experimental design, Nutrient limitation, Heavy metal toxicity, \*Selenastrum, Algal assay forms.

This document is the product of intensive research to improve and expand the understanding of results obtained from the Algal Assay Procedure: Bottle Test (USEPA 1971) to enable investigators to define the stimulatory and/or inhibitory interactions of municipal, industrial and agricultural wastes upon algal productivity in natural waters. This research was designed to determine the impact of nutrients and/or changes in their loading upon algal productivity; whether the growth response of *Selenastrum capricornutum* reflects the response of indigenous species; the feasibility of the assay test protocol to evaluate heavy metals; the capability of the assay to define the effect(s) of complex wastes; and if the assay information can be applied to define and assist in the management of real-world situation. As a result of these research efforts the *Selenastrum capricornutum* Printz Algal Assay Bottle Test: Experimental Design, Application and Data Interpretation Guide is offered now for wider application in both eutrophication and toxicity problem areas. (EIS-Katz)  
W79-0396

### 5B. Sources Of Pollution

**ULTRASTRUCTURAL ALTERATIONS IN THE EGGSHELL GLAND EPITHELIUM OF THE MALLARD DUCK AFTER CHRONIC EXPOSURE TO DDT,**  
Edgewood Arsenal, Aberdeen Proving Ground, MD. Biomedical Lab.  
For primary bibliographic entry see Field 5C.  
W79-03506

**LOWER SANTEE RIVER ENVIRONMENTAL QUALITY STUDY: AN ASSESSMENT OF SELECTED BIOLOGICAL AND PHYSICAL PARAMETERS.**  
South Carolina Water Resources Commission, Columbia.

Report No 122, Estuarine Studies, February 1976, 60 p, 9 fig, 4 tab, 7 ref, 1 append. Nelson, F.P. (editor).

Descriptors: \*Santee River(SC), \*Baseline studies, \*Water quality, \*Basic data collections, Mammals, \*Aquatic plants, South Carolina, Rivers, Diversions, Dissolved oxygen, Biochemical oxygen demand, Nitrogen, Estuaries, Macrophytes, Flora lists, Faunal lists, Hydrology, Water chemistry.

Phytoplankton, Algae, Crawl Creek(SC), Small animals(Mammals).

The Lower Santee River Environmental Quality Study (South Carolina) was originally intended as a hydrobiological baseline for evaluation of future changes (in particular a proposed river flow diversion), but several projected study inputs were not completed. This report includes: (1) a summary of findings and conclusions, (2) a report on water quality (1974-75), (3) a vascular plant survey (1974), and (4) a small mammal survey (1974-75). Tabular data include plant and animal species lists, measurements, and abundance, and 15 water quality parameters: water temperature, DO, BOD<sub>5</sub>, pH, specific conductance, color, turbidity, ammonia, nitrate, nitrite, Kjeldahl nitrogen, phosphorus, fecal coliforms, pesticide residues, and silicon dioxide. Data generally show lower water quality at Crawl Creek, but the pollutant is rapidly diluted or assimilated below the creek's confluence with the Santee. Only the Crawl Creek station had oxygen sag, which with BOD and other parameters indicated waste loading to the creek. Turbidity was low at all upstream stations, but doubled below Wambaw Creek due to suspended materials from the creek plus seawater influence. The Lower Santee is notable for faunal richness and scenic beauty. (Lynch-Wisconsin)  
W79-03513

### CONTINUOUS SIMULATION OF NONPOINT POLLUTION,

Ramit Associates, Berkeley, CA.  
Y. J. Litwin, and A. S. Domigian, Jr.  
Journal of the Water Pollution Control Federation, Vol. 50, No. 10, October 1978, p. 2348-2361. 9 fig, 26 ref.

Descriptors: \*Nonpoint pollution, \*Simulation analysis, \*Water pollution sources, \*Computer models, \*Nonpoint source model, \*Urban runoff, \*Planning, \*Land use, Model studies, Pollutants, Algorithms, North Carolina, Wisconsin, Washington, Third Fork Creek Basin(NC), Manitou Way Storm Drain Watershed(Madison WI), Benaroya Industrial Park Drainage Basin(South Seattle WA), Sedimentation, Runoff, Storm drains, Streams, Watersheds(Basins), Continuous simulation.

Test application of the Nonpoint Source Pollutant Loading Model (NPS) to three urban watersheds demonstrate that continuous simulation of sediment accumulation, generation, and transport by overland flow provides a viable means of assessing land surface contributions of nonpoint pollutants. The model in a single operation can stimulate nonpoint source pollution from five different land use categories. In addition to runoff, water temperature, DO, and sediment, the model simulates up to five user-specified pollutants. Model outputs can provide long-term continuous information on nonpoint pollution that can be used to establish the probability and frequency of occurrence of pollutant loadings under various land use configurations as a basis for evaluating the water quality impact of land use and policy decisions. Main limitations stem from simplification of the processes controlling nonpoint pollution, and the need to calibrate certain model parameters when applying the model to a watershed. When calibrated, the model can be used effectively to evaluate the impact of land use changes, regulations, and proposed plans. The NPS model was tested on the 433-ha Third Fork Creek Basin in Durham, North Carolina, the 60-ha Manitou Way Storm Drain Watershed in Madison, Wisconsin, and the 11.1-ha Benaroya Industrial Park Drainage Basin in South Seattle, Washington. (Lynch-Wisconsin)  
W79-03515

**MONTHLY OXYGEN AND CARBON BUDGETS OF THE NEW YORK BIGHT APEX,**  
Lamont-Doherty Geological Observatory, Palisades, NY.

C. Garside, and T. C. Malone.  
Estuarine and Coastal Marine Science, Vol. 6, No. 1, January 1978, p 93-104, 3 fig, 3 tab, 24 ref. NOAA 03-4-043-310, 04-6-022-44022.

Descriptors: Environmental effects, \*Energy budget, \*Oxygen, \*Carbon, Salinity, Temperature, Seasonal, Respiration, Primary production, Benthos, Water pollution sources.

This paper uses the distribution of primary production, salinity, temperature, dissolved oxygen and particulate organic carbon (POC) to establish monthly oxygen balances for the Apex of the New York Bight. The major source of POC was in situ primary production which was accompanied by high evasive surface oxygen flux and generally by higher levels of water column respiration. A major factor controlling benthic respiration was temperature. A lesser factor was resuspension of substrate material as a result of high runoff. It was concluded that major organic loading events resulting from this river runoff could result in small anoxic regions near the estuary. (Chilton-ORNL)  
W79-03555

### WORKSHOP ON COPPER IN ESTUARINE, CONTINENTAL AND MARINE WATERS.

Department of Energy, Washington, DC. Div of Biomedical and Environmental Research.  
For primary bibliographic entry see Field 5C.  
W79-03564

### AN EXPERIMENTAL ASSESSMENT OF HALEGENATED ORGANICS IN WATERS FROM COOLING TOWERS AND ONCE-THROUGH SYSTEMS,

Oak Ridge National Lab., TN.  
R. L. Jolley, W. W. Pitt, Jr., F. G. Taylor, Jr., S. J. Hartmann, and G. Jones, Jr.  
Available from the National Technical Information Service, Springfield, VA 22161 as CONF-771070-2, Price codes: A02 in paper copy, A01 in microfiche. CONF-771070, Gatlinburg, Tennessee, October 31-November 4, 1977. 13 p, 3 fig, 4 tab, 14 ref.

Descriptors: \*Water pollution sources, \*Air pollution, \*Cooling water, \*Cooling towers, Powerplants, Reactors, Chlorination, Organic compounds, Tennessee, Oak Ridge, Kingston Steam Plant.

In this assessment three cooling systems were studied: the cooling tower systems at the Oak Ridge Gaseous Diffusion Plant and the High Flux Isotope Reactor at Oak Ridge, and the once-through cooling system of the Kingston Steam Plant in Tennessee. Analysis of chlorinated water samples from these sources revealed the presence of numerous nonvolatile uv-absorbing and cerate-oxidizable constituents and it was suggested that these are probably chloro-organics. Chloroform, bromodichloromethane, dibromochloromethane, and bromoform are formed during the chlorination of cooling waters in both closed-cycle and once-through systems. The major portion of the chloroform, bromomethanes and bromoform are rapidly lost to the atmosphere. Data showed that the amount of chloroform lost from the ORGDP and the HFIR totaled more than a ton annually. (Chilton-ORNL)  
W79-03565

### EVALUATION OF VINYL CHLORIDE EMISSIONS IN THE LONG BEACH AREA, CALIFORNIA,

National Field Investigations Center-Denver, CO. Available from the National Technical Information Service, Springfield, VA 22161 as PB-257 642. Price codes: A03 in paper copy, A01 in microfiche. Report No. EPA/330/2-74-002. May 1974. 44 p, 11 fig, 4 tab, 3 append.

Descriptors: \*Pollutant identification, \*Vinyl chloride, \*Water pollution, \*Air pollution, \*Industrial wastes, Effluents, Water pollution sources, Hazards, Waste treatment, Sampling, Sludge, American Chemical Corporation, B.F. Goodrich Chemical Company, Long Beach, California, Surveys, Toxicity, Public health.

A survey of vinyl chloride emissions was conducted at the American Chemical Corporation and

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## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Sources Of Pollution—Group 5B

B.F. Goodrich Chemical Company in Long Beach, California. It was found that vinyl chloride monomer (VCM) was being emitted from the plants via water, sludge, and air. An estimated five lbs/day leave the B.F. Goodrich plant and 22 lbs/day leave the American Chemical plant in the waste water effluents. Evaluations for both plants are presented, major waste water sources are identified, and plant waste water treatment systems are described. The sampling program consisted of waste water samples taken from three sampling stations at B.F. Goodrich and seven stations at American Chemical; grab samples of ambient air were taken from 15 locations surrounding the plant and analyzed with the Wilks Scientific MIRAN Portable Gas Analyzer. On site release of VCM to the air during venting, cleaning or by accident, was monitored by infrared spectrometer. Indications are that these plants will be routinely in violation of the standard proposed by the Occupational Safety and Health Administration for employee exposure level. (Davison-IPA) W79-03577

#### PARAQUAT SORPTION AS A FUNCTION OF PARTICLE SIZE IN NATURAL SEDIMENTS, Environmental Research Lab., Athens, GA.

S. W. Karickhoff and D. S. Brown.

Journal of Environmental Quality, Vol. 7, No. 2, p 246-252, April-June, 1978. 1 fig, 6 tab, 13 ref, 9 equ.

Descriptors: \*Paraquat, \*Sorption, Adsorption, Particle size, Pesticides, Pollutants, \*Sediments, Isotherms, Cation exchange, \*Clay mineral.

The distribution of sorbed paraquat as a function of particle size (sand through clay) was determined on five natural sediments. Paraquat concentrations in individual size fractions varied as much as two orders of magnitude within a given sediment, showing a pronounced preference for the fine silt and clay fractions. Adsorption isotherms were measured for individual size separates on one sediment. Paraquat distributions in the whole sediment agreed well with those computed using the isotherm coefficients determined on individual size separates. Paraquat sorbs by ion exchange, and sorption partition coefficients showed a definite correlation with the cation exchange capacity (CEC) of individual size fractions. However, exchange sites in different fractions differed in their effectiveness in sorbing paraquat, with the fine silt and clay exchange sites being more effective than those of the larger separates. In pure clay suspensions (fectorite and montmorillonite), sorbed paraquat did not distribute uniformly throughout the clay particle size range. It was concluded that for highly sorbed compounds such as paraquat, conventional phase separation techniques for measuring sorption may not distinguish sorbed vs. "free" compounds. (Skogboe-Colorado State) W79-03595

#### UTILIZATION OF THE STEAM DISTILLATION PROCEDURE FOR THE DETERMINATION OF METHYL MERCURY IN FISH AND SHELLS BY GAS-LIQUID CHROMATOGRAPHY, (IN JAPANESE), Yamaguchi Prefectural Research Inst. of Health, (Japan).

For primary bibliographic entry see Field 5A. W79-03635

#### DYNAMIC MODEL OF NUTRIFICATION IN HUNTINGTON BAY, NEW YORK,

Long Island Univ., Greenvale, NY. Dept. of Marine and Environmental Science.

D. J. Yezzi, Jr. and A. P. Uzzo, Jr. Ecological Modelling, Vol. 6, p 59-75, 1979. 3 fig, 4 tab, 23 ref.

Descriptors: \*Model studies, \*Nutrients, Bays, Phytoplankton, Zooplankton, Nitrogen, Phosphorus, Mathematical models, Ammonia, Nitrates, Chemical analysis, Municipal wastes, Sediment transport, Trophic levels, Predation, Growth rates, Productivity, Ecosystems, Estuaries, \*Huntington Bay(NY), \*New York, Long Island Sound.

A dynamic simulation model of nutrification with respect to phytoplankton and zooplankton levels in Huntington Bay is developed. The validity of relationships used by previous researchers in freshwater environments is tested under marine conditions. Nutrients are modelled, and it is shown that nitrogen is the limiting nutrient in the bay. Phosphorus is not found to be limiting. (EIS-Deal) W79-03638

#### POLLUTION PROFILE OF A RIVER, Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.

A. D. Paul, and K. C. Pillai.

Water, Air and Soil Pollution, Vol. 10, p. 133-146, 1978. 6 fig, 7 tab, 9 ref.

Descriptors: \*Radioisotopes, \*Thallium radioisotopes, Uranium radioisotopes, Rivers, River flow, Industrial wastes, Chemical wastes, Water quality, Water chemistry, Sediment transport, Chemical analysis, Acids, Salts, Metals, Path of pollutants, Suspended solids, Deposition(Sediments), Sedimentation, Water Pollution sources, \*Periyar River(So India), \*India.

A host of chemical industries subject the Periyar River (India) to pollutants such as acids, alkalies and their salts, trace metals and radionuclides belonging to the Th and U chains. Proximity of different outfalls and poor lateral mixing in the river are responsible for high local aquatic concentrations. Scavenging reactions, in situ, and sedimentation of suspended matter result in the accumulation of radionuclides near the outfall area. The monsoon 'flushes out' the river into the backwater area. Translocation of sediments is the major factor in the transport of pollutants. (EIS-Deal) W79-03641

#### MERCURY BIOCONCENTRATION IN FISH: TEMPERATURE AND CONCENTRATION EFFECTS.

Northwestern Univ., Evanston, IL. Dept. of Environmental Health Engineering.

H. Cember, E. H. Curtis, and B. G. Blaylock. Environmental Pollution, Vol. 17, p. 311-319, 1978. 4 fig, 3 tab, 4 ref.

Descriptors: \*Mercury, \*Sunfishes, Chemical analysis, Path of pollutants, Heavy metals, Water chemistry, Water analysis, Industrial wastes, Chemical wastes, Mortality, Fish physiology, Animal metabolism, Absorption, Food chains, Public health, \*Bioconcentration, \*Bioaccumulation, \*Tissue analysis.

Mercury bioconcentration factors in bluegill sunfish (*Lepomis macrochirus*) were investigated over a period of 688 h by exposing the fish to  $\text{CH}_3\text{HgCl}$  at water temperature of 9 degrees C 21 degrees C and 33 degrees C and Hg concentrations of 0.0002, 0.0005, 0.005 and 0.05 ppm. The bioconcentration factor was found to increase exponentially with water temperature at a rate of 0.066 per degree C. Mercury concentration in the water did not influence the bioconcentration factor. (EIS-Deal) W79-03643

#### ACCUMULATION OF THE ORGANOPHOSPHATE BLACKFLY LARVICIDE ABATE (TEMEPHOS) IN SAROTHERODON MOSSAMBICUS, WITH REFERENCE TO THE LARVICIDAL CONTROL OF SIMULIUM DAMNOSUM, Centre for Overseas Pest Research, London (England).

For primary bibliographic entry see Field 5C. W79-03647

#### 237PU EXPERIMENTS WITH THE THORN-BACK RAY RAJA CLAVATA.

Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Radiobiological Lab.

For primary bibliographic entry see Field 5A. W79-03649

REGULATION OF COPPER AVAILABILITY TO PHYTOPLANKTON BY MACROMOLECULES IN LAKE WATER, Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).

R. Gachter, J. S. Davis, and A. Mares. Environmental Science and Technology, Vol. 12, No. 13, p 1416-1421, 1978. 7 fig, 2 tab, 27 ref.

Descriptors: \*Copper, \*Phytoplankton, \*Filtration, Lakes, Filters, Membranes, Photosynthesis, Physiology, Metabolism, Bioassay, Chemical analysis, Water chemistry, Water analysis, Toxicity, Metals, Path of pollutants, Copper compounds, \*EDTA, \*Ligands.

Approximately two-thirds of the copper in lake water remains in the nonfilterable residue of the following two-step procedure: 0.45 Micro m filtration followed by Diaflo UM-2 membrane (passing mol wt 1000) ultrafiltration. Examination of the effect of this residual copper on the photosynthesis rate of natural phytoplankton has shown that this residual copper is physiologically not available to the organisms. This fact can be utilized in a bioassay (as demonstrated with EDTA as a test substance) to gain information on the concentration of a ligand and its apparent association constant with copper. It is concluded that nonultrafilterable ligands present in lake water form copper complexes as stable as the CuEDTA complex and can thus play an ecologically significant role in the regulation of copper availability and therefore its toxicity to phytoplankton. (EIS-Deal) W79-03651

#### THE EFFECTS OF COAL ASH BASIN EFFLUENT AND THERMAL LOADING ON BACTERIAL POPULATIONS OF FLOWING STREAMS,

Texas Univ. Health Science Center, Houston.

For primary bibliographic entry see Field 5C. W79-03659

#### FACTORS AFFECTING ATRAZINE ADSORPTION, DEGRADATION AND MOBILITY IN SOIL,

Nebraska Univ., Lincoln. Dept. of Agronomy.

T. H. Dao. Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 575, Price codes: A05 in paper copy, A01 in microfiche. Ph.D. Dissertation, May 1977. 68 p, 11 fig, 11 tab, 29 ref. OWRT B-030-NEB(5). 14-34-0001-5087.

Descriptors: \*Herbicides, \*Adsorption, Leaching, Water quality, \*Atrazine, \*Leaching, \*Degradation(Decomposition), \*Path of pollutants, Soils.

Experiments were conducted to study the process of adsorption, degradation and leaching of atrazine and the interrelationship of these processes in soil. Adsorption isotherms for atrazine were described by the Freundlich equation. Decrease in water:soil ratio, from 5:1 to 0.4:1 and in soil moisture content, from 0.1 to 0.3 bar moisture content led to an increase in adsorption of atrazine on soil. Increasing the concentration of electrolyte added to soil increased atrazine adsorption by reducing the solubility of the herbicide in solution. Increasing soil temperature from 5C to 30C increased atrazine adsorption on soil. This endothermic reaction was observed both before and after correction for differential atrazine solubility due to temperature. Thermodynamic quantities associated with the adsorption reaction were calculated to characterize the adsorption of atrazine on soil. Simultaneous degradation and fixation occurred during the leaching of atrazine through soil with 30 cm of water. Decreasing the water flow rates from 2 cm/hr to 1 cm/day greatly reduced the mobility of atrazine in saturated soil columns. The contribution of the diffusion process to the overall movement of atrazine in soil was estimated to be small. The diffusion coefficients of atrazine in saturated soils were in the order of 0.2 to  $1.1 \times 10^{-7} \text{ cm}^2/\text{sec}$ . W79-03670

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources Of Pollution

#### ADSORPTION AND DESORPTION IN MINE DRAINAGES

Colorado School of Mines, Golden,  
L. J. Holcombe.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 614, Price codes: A06 in paper copy, A01 in microfiche. MS Thesis (1977). 98 p. OWRT A-034-COLO(2). 14-34-0001-7012.

Descriptors: \*Adsorption, \*Desorption, \*Sediment deposition, \*Mineralization, Water quality, \*Mine drainage, \*Colorado mineral belt, Model studies, \*Heavy metals, Water chemistry, Ion exchange.

In this report is analyzed the solid sediment deposited in a mine drainage and its effect on the solution chemistry; specifically, the adsorption of heavy metals by the hydrous oxides of manganese and iron. Forty-two sediment samples were collected from mine drainages in the Front Range and sieved to minus eighty mesh. A selective chemical attack on the sediments with a hydroxylamine hydrochloride and acetic acid mixture showed that manganese oxides controlled the amount of Co, Cu, Cd, Zn and Ni in the sediment. Hydrous oxides of iron, did not adsorb metals from solution and had a negative correlation with Mg, Al, Ca, Na, K, Cu, Pb, Ni, Mn, Zn, Co, and Cd. The sorption behaviors of manganese and iron hydrous oxides are strongly controlled by pH. At the low pH's of the mine drainages, iron oxides have a positive surface charge, thus preventing the adsorption of cations; manganese oxides have a negative surface charge at these pH's. Through the extraction method it was found that a large portion of the mine drainage sediments are adsorbed or precipitated material, the exact percentage being dependent on pH, Eh, complexing agents, stream flow, sediment distribution co-efficients and other factors. A model was designed and tested which will enable an experimenter to determine the distribution or isotherm for a metal between its aqueous form and as adsorbed species. The isotherm method involves equilibration of a metal in solution with complexing agents and ion-exchangers, with subsequent determination of all forms of the metal. The ion-exchange method was used to determine the free metal and complexed metal concentrations in solution. Under ideal laboratory conditions, using synthetic exchangers and controlled solution parameters, the isotherm method was accurate in determining the 'true' isotherm for Zn(II) when citrate was present as a complexer.

W79-03673

#### THE EFFECT OF HIGH 2, 4-D CONCENTRATIONS ON DEGRADATION AND CARBON DIOXIDE EVOLUTION IN SOILS

Florida Univ., Gainesville. Dept. of Soil Science; and Florida Univ., Gainesville. Dept. of Food Science and Human Nutrition.

L-T. Ou, D. F. Rothwell, W. B. Wheeler, and J.

M. Davidson.

Journal of Environmental Quality, Vol. 7, No. 2, p. 241-246, April-June, 1978. 6 fig, 6 tab, 13 ref.

Descriptors: Pesticides, \*Herbicides, \*Pesticide residues, Persistence, \*Microbial degradation, Pesticide toxicity, Carbon dioxide, Waste disposal, \*2,4-D.

A laboratory experiment was conducted to determine the degradation of high concentrations of 2,4-D (2,4-dichlorophenoxyacetic acid) and CO<sub>2</sub> evolution in three soils. Two forms of 2,4-D, technical grade and formulated, were added to each soil at rates of 50, 500, 5,000 and 20,000 micrograms/g of soil (ppm). Degradation of the 2,4-D was measured by 14CO<sub>2</sub> evolution resulting from the oxidation of uniformly ring-labeled carbon. At an application rate of 500 ppm, all three soils degraded 2,4-D. At 5,000 and 20,000 ppm, degradation occurred in the Webster silty clay loam and Terra Ceia organic soil, but not in the Cecil sandy loam during 80 days of incubation. The degradation rate was generally higher for the formulated 2,4-D than the technical grade material. For the higher 2,4-D concentrations, 5,000 or 20,000 ppm, when extensive degradation occurred, total CO<sub>2</sub> evolution was also greatly stimulated, and the pattern of total CO<sub>2</sub>

evolution rate exhibited a two-peak response. Carbon dioxide-carbon (CO<sub>2</sub>-C) from the first peak appeared to be mainly from the formulation materials or from the impurities and CO<sub>2</sub>-C from the second peak was mainly from 2,4-D-C. (Skogboe-Colorado State) W79-03678

#### EFFECT OF SOIL MOISTURE CONTENT UPON ADSORPTION AND MOVEMENT OF PHOSPHORUS FROM LEACHATES OF DOMESTIC WASTE DISPOSAL SYSTEMS

T. G. McNeice.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 561, Price codes: A04 in paper copy, A01 in microfiche. MS Thesis, August 1978. 74 p, 21 fig, 3 tab, 54 ref. OWRT A-044-ME(1).

Descriptors: Porous media, Hydraulic properties, Soils, Septic tanks, \*Adsorption, \*Soil moisture, \*Phosphorus, Organic matter, Saturation, Penetration, \*Moisture content, Waste water disposal fields, \*Leachates, Path of pollutants, Adams soil, Soil columns, Phosphorus adsorption.

Physical principles of porous media flow were used to establish functional relationships between hydraulic properties of an Adams soil. Soil columns simulating septic tank adsorption fields were used in conjunction with the hydraulic property data to investigate effect of soil moisture content upon the adsorption and movement of phosphorus. Experimental tests were employed to determine other factors such as pH and organic matter content specific to the Adams soil, which could effect phosphorus retention. It was demonstrated that the effect of reducing the level of saturation in a soil is to greatly increase the amount of phosphorus adsorbed and thereby limit the depth of penetration. W79-03683

#### MEASUREMENT OF THE ENGINEERING PROPERTIES OF MUNICIPAL INCINERATOR RESIDUES AND CONSIDERATION OF LEACHATE CHARACTERISTICS

G. G. Jillson.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 675, Price codes: A05 in paper copy, A01 in microfiche. MAster of Science Thesis, 1976. 92 p, 29 fig, 14 tab, 2 append, 14 ref. OWRT A-67-CONN(3), 14-31-0001-6007.

Descriptors: \*Incineration, \*Sewage sludge, \*Leachate, \*Waste disposal, \*Landfills, \*Municipal wastes, \*Incinerator residue, \*Solid wastes, Hydraulic properties, Mechanical properties, Batch feed solid waste incinerator, Continuous feed sewage sludge incinerator.

The hydraulic and mechanical properties of incinerated municipal solid waste and incinerated sewage sludge were measured. The specific tests carried out were: Standard Proctor density, saturated permeability, triaxial strength and one-dimensional strength tests. These tests were performed on samples from a batch feed solid waste incinerator, a continuous feed solid waste incinerator and a continuous feed sewage sludge incinerator. The results indicated that all three types of incinerator ash are a stable, lightweight fill material that when compacted could be used as landfill cover in recreational areas or any other use that does not require high strength or stiffness. The permeability of the compacted ash is high enough to allow infiltration of 90% of the rain that falls on it if the water table is below the surface. If the leaching of chemicals is to be prevented, the ash must be kept dry by an impervious cover or be placed in a pit lined with an impervious material.

W79-03685

#### METHODOLOGIES OF EXAMINING POLLUTION FROM URBAN RUNOFF

Rutgers - The State Univ., New Brunswick, NJ. Dept. of Civil and Environmental Engineering.

J. M. DiLouie.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 595, Price codes: A07 in paper copy, A01 in microfiche. M.S. Thesis, October 1978. 120 p, 50 fig, 18 tab. OWRT A-046-NJ(3), B-059-NJ(2), B-063-NJ(2), 14-34-0001-5128, 7124.

Descriptors: \*Urban runoff, \*Storm runoff, \*Rainfall intensity, \*Antecedent precipitation, \*Pennsylvania, \*New Jersey, Chemical oxygen demand, Biochemical oxygen demand, Suspended solids, Phosphates, Nitrates, Ammonia, Pollutant loadings.

This thesis is addressed to the methodologies of examining urban storm water runoff data by investigating relationships between the pollutant loading from each storm event and criteria such as runoff, the number of days since the last significant rainfall, and rainfall intensity. Sampling sites were located in North Philadelphia, Pennsylvania; and Trenton, Hamilton Township and East Windsor in New Jersey. Pollution parameters of concern for this paper are limited to nitrate expressed as nitrogen, suspended solids, chemical oxygen demand, 5-day BOD, total phosphates expressed as total phosphorus, and ammonia expressed as nitrogen. During the period of 6/1/76 to 10/1/77, 28 storm events were sampled. There appears to be some type of positive correlation between the pollutant loadings examined and the amount of runoff. However, the correlation is different for each site. In the realm of days since last significant rainfall versus pollutant loadings, no significant, outstanding, or consistent relationships were found, implying that there may be no basis to this concept. In general, the greater the intensity, the greater the pollutant loading. This was most strongly exhibited in the parameter of COD. The remaining parameters, except suspended solids, showed this tendency also.

W79-03689

#### MOTORBOAT USE ON THE WILD ROGUE RIVER: AN INVESTIGATION OF USE BETWEEN WATSON CREEK AND BLOSSOM BAR

Oregon State Univ., Corvallis. Dept. of Geography.

P. E. Donheffner, and K. W. Mucklestone.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 593, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute, Oregon State University Report WRR1-52, December 1976. 60 p, 6 fig, 8 tab, 7 append. OWRT A-999-ORE(21).

Descriptors: \*Recreation, \*Motorboat pollution, River recreation, Riverine planning, \*Wild Rogue River(Ore), \*Oregon, Water utilization, Monitoring.

A study of private motorboat use on the lower nine miles of the Wild Rogue River was conducted to determine present and historical use levels. Motorized use was monitored daily, and a survey of private motorboaters undertaken using personal interviews. There is a long history of motorboat use in the study area; it was well established by 1968 when part of the Rogue was designated as Wild River. All types of motorized use have increased since then, especially commercial and administrative use. Private use in 1976 is estimated at 1,000 trips, not all of which were recreational. There is considerable variation in the spatial and temporal patterns of use; over 30 percent of all private use takes place in September and October. Fishing is the primary reason for private motorboat use. The greatest problem reported by private motorboaters was courtesy by downriver, drift users.

W79-03695

#### FATE OF 2, 4-D IN A NAFF SILT LOAM SOIL

Nebraska Univ. Panhandle Station at Scottsbluff.

R. G. Wilson, Jr., and H. H. Cheng.

Journal of Environmental Quality, Vol. 7, No. 2, p. 281-286, April-June, 1978. 3 fig, 4 tab, 16 ref.

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## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Sources Of Pollution—Group 5B

**Descriptors:** \*Adsorption, \*Hydrolysis, \*Chemical degradation, \*Microbial degradation, Weed control, \*2,4-D, Herbicides.

Laboratory studies were conducted to determine the adsorption, desorption, hydrolysis, and breakdown of commercially formulated isooctyl ester and dimethylamine salt of (2,4-dichlorophenoxy) acetic acid (2,4-D) in a Naff silt loam soil. More 2,4-D was adsorbed to the surface soil than to soil at lower depths, and the percentage of 2,4-D adsorbed decreased as the total amount of 2,4-D present increased. Formulated 2,4-D isooctyl ester applied to moist soil underwent hydrolysis to the anionic form at a rapid rate, with less than 80 percent of the ester hydrolyzed in 72 hours. High amounts of 2,4-D in runoff (sediment and water) retarded the active degradation of carboxyl-14C 2,4-D when 2,4-D was incubated in runoff from a wheat field treated with various formulations and rates of 2,4-D. The presence of the ester formulation at the high rate of application increased the lag period before degradation of carboxyl-14C and ring-14C 2,4-D occurred in soil. However, once the active breakdown of carboxyl-14C and ring-14C 2,4-D was initiated, little difference could be detected in the degradation patterns. At the end of the 10 weeks of incubation in runoff or in soil, only 1 percent of the 14-C 2,4-D originally applied to the soil could be identified as 2,4-D. (Skogerboe—Colorado State) W79-03702

#### COMPARATIVE STUDY OF TOXICITY, UPTAKE AND DISTRIBUTION OF CADMIUM AND MERCURY IN THE SEA WATER ADAPTED EEL ANQUILLA ANQUILLA,

Liege Univ. (Belgium). Lab. d'Oceanologie.

F. Noel-Lambot, and J. M. Bouquegneau.

Bulletin of Environmental Contamination and Toxicology, Vol. 18, No. 4, p. 418-424, 1977. 1 fig, 1 tab, 26 ref.

**Descriptors:** \*Mercury, \*Cadmium, \*Toxicity, Mortality, Spectrophotometry, Absorption, Membrane processes, \*Eels, Lethal limit, Permeability, Path of pollutants, Animal metabolism, Chlorides, Metals, Tissue analysis, Bioaccumulation, Anquilla, Gills.

Toxicity test results show that eels are much more susceptible to  $HgCl_2$  exposure than to  $CdCl_2$  exposure. In terms of tissue distribution, maximum concentrations were attained in the kidneys in both cases. Next came the digestive tract and the liver in the case of Cd, the spleen, the gills and the liver in the case of Hg. When results were expressed as organ metal load compared to whole body content, the digestive tract, kidneys, and liver contained 56% of the total Cd, while 66% of the total Hg was concentrated in the muscles. (Katz-EIS) W79-03730

#### MICROBIAL POPULATIONS IN FLOODED SWAMP SOILS OF SOUTH CAROLINA,

Southeastern Forest Experiment Station, Asheville, NC.

For primary bibliographic entry see Field 2G. W79-03742

#### A CONCEPTUAL MODEL FOR THE MOVEMENT OF PESTICIDES THROUGH THE ENVIRONMENT: A CONTRIBUTION OF THE EPA ALTERNATIVE CHEMICALS PROGRAM,

National Ecological Research Lab., Corvallis, OR.

J. W. Gillett, J. Hill, IV, A. W. Jarvinen, and W. P. Schoor.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-238 653, Price codes: A05 in paper copy, A01 in microfiche. Report No EPA-660/3-74-024, December 1974. 86 p, 21 fig, 42 ref. IEA487.

**Descriptors:** \*Model studies, \*Ecosystems, \*Pesticides, Pesticide drift, Pesticide kinetics, Pesticide residues, Movement, Path of pollutants, Food chains, Theoretical analysis, Systems analysis.

A conceptual model of the movement and disposition of pesticides in the environment is developed in order to permit judicious collection and evaluation of data at the critical points in that disposition. It is the first step in organizing facts, assumptions, and hypotheses into a logical, graphic array which can ultimately be exploited through the use of systems analysis and mathematical simulation techniques to evaluate the fate of a specific chemical in a particular environment. A graphic model is built up from simple modules representing basic processes and components of air, flora, fauna, soil and water, as well as mechanisms of disposition such as convective mass transport, interparticle diffusion, co-distillation, condensation, intra-particle diffusion, ingestion, adsorption/desorption, chemical transformation, and biological alteration. These elements were used in the development of more specific models for the atmospheric/terrestrial, freshwater aquatic and estuarine/marine environments. While the concept of a model with global validity was rejected, the commonalities of the basic processes and components in these environments was emphasized, and it was suggested that through iterative operations of expansion and systematic reduction of processes and components, these environments could be joined to provide a holistic view of a chemical's disposition and effects. (Luedtke-Wisconsin) W79-03757

#### THE BEHAVIOR OF NUTRIENT ELEMENTS ADDED TO A FOREST SOIL WITH SEWAGE SLUDGE,

Washington Univ., Seattle. Center of Ecosystem Studies.

H. Riekerk.

Soil Science Society of America, Vol. 42, No. 5, p 810-816, September-October 1978. 5 fig, 1 tab, 23 ref.

**Descriptors:** \*Sewage sludge, \*Forest soils, \*Nutrient removal, On-site investigations, Nutrients, Groundwater, Leaching, Rainfall, Nitrogen, Phosphorus, Potassium, Calcium, Anions, Cations, Ion exchange, Hydrogen ion concentrations, Groundwater movement.

Sludge applications were made at a rate of 247 metric tons/ha dry weight to a cleared gravelly Douglas fir forest soil to test limits of nutrient conservation mechanisms. First year losses due to treatments were 8% of added N, 15% of Ca, 1% of K, and none of P. Predictably,  $NO_3^-$  N was the dominant mobile anion significantly increasing the calcium nitrate level in the groundwater. Differences between sludge treatments, including plowing, reflected the degree of aeration and decomposition of  $NO_3^-$  N production and P-fixation. These differences were more pronounced deeper in the soil, except for K which was more controlled by the stage of weathering. A very heavy sludge application rate (618 metric tons/ha) had less impact on soil nutrient behavior due to a high water absorption capability. Alternate ways of reducing  $NO_3^-$  N leakage from the forest soil are being investigated. (Sims-ISWS) W79-03805

#### POTENTIAL SOURCES OF ASBESTOS IN LAKE MICHIGAN,

Illinois Univ. at the Medical Center, Chicago. School of Public Health.

C. S. Hesse, and W. H. Hallenbeck. Journal of Great Lakes Research, Vol. 4, No. 1, p 57-61, March 1978. 37 ref.

**Descriptors:** \*Asbestos, \*Lake Michigan, \*Water pollution sources, Water pollution, Industries, Geology, Atmosphere, Currents(Water), Dredging, Pollutants, Path of pollutants, Lakes, Surveys.

Chrysotile and amphibole mineral fibers, recognized carcinogens, have been found in Lake Michigan water. Since the sources of these fibers in Lake Michigan are unknown, a study was undertaken to determine potential sources. Information was gathered by contacting governmental agencies and reviewing literature. Two industries that used to discharge asbestos-containing effluents are located

in the Lake Michigan drainage basin. Geologic deposits of mineral fibers occur in Marinette County, Wisconsin, and the Upper Peninsula of Michigan. Currents and Army Corps of Engineers dredging and disposal activities were investigated as potential mechanisms of asbestos distribution in Lake Michigan. Limited environmental monitoring indicated that atmospheric loading and wash-out from numerous point and non-point sources may be an important mechanism of asbestos contamination of Lake Michigan. More environmental monitoring will be required in order to determine the relative importance of these potential sources. (Sims-ISWS) W79-03809

#### MIREX IN THE SEDIMENTS OF LAKE ONTARIO,

Ontario Ministry of Agriculture and Food, Guelph. Pesticide Residue Lab.

M. V. H. Holdren, R. Frank, R. L. Thomas, and L. J. Hetling.

Journal of Great Lakes Research, Vol 4, No 1, p 69-74, March 1978. 2 fig, 4 tab, 12 ref.

**Descriptors:** \*Pesticides, \*Sediments, \*Lake Ontario, Sampling, Surveys, Distribution patterns, Water pollution, Water pollution sources, Suspended solids, Chemical analysis, Insecticides, Rivers, Runoff, Lakes, Lake sediments, \*Mirex.

Analysis of sediment samples collected in Lake Ontario in 1968 revealed the occurrence of mirex in two anomalous zones related to input from the Niagara and Oswego Rivers. These anomalies were confirmed in a 1976 resampling program. A suspended solids sample taken in the Niagara River confirmed an upstream source (Hooker Chemical) of the compound. Bottom sediment samples in the Oswego River identified an industrial source (Armstrong Cork) 14 km upstream of the river mouth. Known use of mirex by this plant indicated a substantial loss some 15 years ago. This was confirmed by sediment coring in the open lake sediments indicating that mirex deposition commenced 7 to 14 years before present. (Sims-ISWS) W79-03810

#### THEORETICAL MODEL OF THE LITTORAL DRIFT SYSTEM IN THE TORONTO WATERFRONT AREA, LAKE ONTARIO,

Scarborough Coll., Toronto (Ontario).

For primary bibliographic entry see Field 2H. W79-03811

#### CARBON FLOW IN FOUR LAKE ECOSYSTEMS: A STRUCTURAL APPROACH,

Washington Univ., Seattle. Fisheries Research Inst.

For primary bibliographic entry see Field 5C. W79-03815

#### THE MECHANISMS OF CARBON DIOXIDE FIXATION IN PHYTOPLANKTON,

Bigelow Lab. for Ocean Sciences, West Boothbay Harbor, ME.

For primary bibliographic entry see Field 5C. W79-03860

#### A MATHEMATICAL MODEL FOR GROWTH OF PHYTOPLANKTON,

Novo Industri A/S, Bagsvaerd (Denmark).

For primary bibliographic entry see Field 5C. W79-03862

#### ACCUMULATION OF LEAD BY SEVERAL GREEN ALGAE,

Staatsinstitut fuer Allgemeine Botanik, Botanischer Garten und Anzuchtgarten Fuhlsbuettel, Hamburg (Germany, F.R.).

For primary bibliographic entry see Field 5C. W79-03867

#### N-UPTAKE AND PIGMENTATION OF N-LIMITED CHEMOSTAT CULTURES AND NATU-

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources Of Pollution

**RAL POPULATIONS OF OSCILLATORIA AGARDHII,**  
Amsterdam Univ. (Netherlands). Lab. for Microbiology, Amsterdam (Netherlands).  
For primary bibliographic entry see Field 5C.  
W79-03868

**EFFECTS OF RIVER DISCHARGE ON THE COASTAL PHYTOPLANKTON CYCLE,**  
Norwegian Fisheries Directorate, Arendal, Stavanger Biological Station.  
For primary bibliographic entry see Field 5C.  
W79-03873

**A STEADY-STATE PHYTOPLANKTON MODEL OF CHESAPEAKE BAY,**  
Hydroscience, Inc., Westwood, NJ.  
For primary bibliographic entry see Field 5C.  
W79-03899

**SIMULATION OF POTENTIAL POLLUTANT-CAUSED CHANGES IN THE ECOSYSTEM, RESULTING FROM THE SENSITIVITY OF AQUATIC ORGANISMS TO TOXICANTS,**  
Moscow State Univ. (USSR). Faculty of Biology.  
For primary bibliographic entry see Field 5C.  
W79-03920

**GEOLOGIC POLLUTION PROBLEMS OF LAKE SUPERIOR,**  
A. B. Dickas.

In: Proceedings of the First and Second USA-USSR Symposium on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. II, Environmental Protection Agency, Report EPA-600/3-78-076, p. 133-140, 1978, 1 tab., 16 ref.

**Descriptors:** \*Lake Superior, \*Water quality, \*Public health, Erosion, Erosion rates, Clay minerals, Clays, Red clay, \*Asbestos, Cummingtonite, Mining, Mining wastes, Water pollution effects, Waste treatment, Geologic pollution.

The effects of man's activities on the water quality of Lake Superior are reviewed. As a result of mining activities, cummingtonite and other asbestos type minerals have been discharged into Lake Superior. The possible effects of these discharges are discussed. The water quality of Lake Superior are also affected by the extensive erosion of red clay deposits. (See also W79-03906) (EIS-Katz) W79-03938

**NATIONAL CONFERENCE ON MANAGEMENT OF NITROGEN IN IRRIGATED AGRICULTURE.**

For primary bibliographic entry see Field 5G.  
W79-03941

**SOURCES OF NITROGEN FOR CROP UTILIZATION,**  
Potash/Phosphate Inst. Manhattan, KS.  
For primary bibliographic entry see Field 5G.  
W79-03944

**ESTIMATING THE INFLUENCE OF SOIL RESIDENCE TIME ON EFFLUENT WATER QUALITY,**  
California Univ., Riverside. Dept. of Soil and Environmental Sciences.

For primary bibliographic entry see Field 5G.  
W79-03951

**A CASE STUDY-NITRATES IN THE UPPER SANTA ANA RIVER BASIN IN RELATION TO GROUNDWATER POLLUTION,**  
California Univ., Davis. Dept. of Land, Air and Water Resources.

R. S. Ayers.

In: National Conference on Management of Nitrogen in Irrigated Agriculture, p. 355-367, 1978, 2 fig., 1 tab., 4 ref.

**Descriptors:** \*Nitrates, \*Nitrogen, Water management(Applied), Fertilization, Waste disposal, Pollutant identification, \*California, \*Santa Ana River(Calif), \*Groundwater, Water pollution.

In response to a request from the Santa Ana Watershed Planning Agency (a regional planning agency) the Kearney Foundation of Soil Science of the University of California conducted an interdisciplinary 3-month study of the nitrate problem in the Basin. The study was limited to the upper part of the basin where nitrate degradation of waters was more serious. The study included (1) a review of available data to identify existing areas of high nitrate concentrations in underground waters, (2) a review of past land use, water and fertilizer use and waste disposal practices, and (3) estimates of the impact of irrigation, fertilization and use of animal wastes on leaching of nitrate from root zones. Guidelines for the use of water, fertilizers and manures were developed. (See also W79-03941) (Skogerboe-Colorado State) W79-03955

**PCBS: THEIR ENVIRONMENTAL SIGNIFICANCE AND DISTRIBUTION IN RHODE ISLAND,**  
Rhode Island Univ., Narragansett. Coastal Resources Center.

A. J. Paulson, and D. T. Brown.  
Sea Grant Program, Marine Technical Report No. 68, July 1978. 29 p, 2 fig, 6 tab, 44 ref.

**Descriptors:** \*Polychlorinated biphenyls, \*Water pollution sources, \*Toxicity, Chemistry, Rhode Island, Landfills, Waste disposal, Path of pollutants, Water quality control.

Summary information on PCB chemistry, sources, transport mechanisms, and toxicity, with focus on the marine environment is provided. The existing data on PCBs in Rhode Island are presented and assessed in the second part of the report. From this review and assessment the following conclusions can be made: PCBs, although present in the Rhode Island environment, are not a major pollution problem. Data on PCBs in Rhode Island ecosystems are scanty. Additional information would provide a clearer picture of PCB distribution but it is not considered to be of high priority, since the available data suggest that present levels are low. (NOAA) W79-03964

**SOURCE ASSESSMENT: OPEN MINING OF COAL, STATE OF THE ART,**  
Monsanto Research Corp., Dayton, OH.  
For primary bibliographic entry see Field 5G.  
W79-03969

**OVERVIEW OF THE FRESH PACK FOOD INDUSTRIES,**  
SRI International, Menlo Park, CA.

L. R. Somogyi, and P. E. Kyle.  
Report No. EPA-600/2-78-216, December 1978. 110 p, 10 fig, 22 tab, 27 ref. R804642-01.

**Descriptors:** \*Industrial wastes, Agriculture, \*Water pollution sources, \*Foods, \*Organic wastes, Water users, Effluents, Apples, Citrus fruits, Grapefruit, Fruit crops, Lemons, Lettuce, Onions, Potatoes, Vegetable crops, Salmon, Marine fish, Oysters, Nuts, Fresh foods, Eggs, Fresh produce, Waste disposal, Solid wastes, Organic wastes, Waste water(Pollution).

Substantial amounts of water are used, and organic wastes are produced during market preparation of most fresh fruits, vegetables, fish, and shell eggs. In assessing the pollution contributions of the fresh produce handling industry, the common unit operations applied after harvest, the water usage and waste disposal associated with the ten highest volume crops were reviewed. Two nut crops, two species of fish, and fresh eggs were included in the investigation because of their special handling requirements. It was found that although the industries are not a major source of air pollutants, they are major sources of solid wastes in the form of

natural organic substances. Much of these wastes are returned to the field, or used as byproducts, fuel, or feed, with only small amounts handled in central locations where they may periodically create local problems when disposed to urban sewage systems. In addition to washing, cleaning water is used for transporting fruits through grading and inspection systems, and for cooling fresh fruits, fish, and vegetables. Large volumes of waste water containing various strengths of organic pollutants are created. Significant quantities of water are used in the market preparation of apples, oranges, lemons, and potatoes. The waste water contains some detergent compounds applied during the cleaning processes; cleaning water and cooling water are often treated with germicides. Chlorine is the most common germicide. Pesticide residues and potentially hazardous chemicals are used at very low concentrations, and are not likely to harm the environment. (Davison-IPA) W79-03970

**ASSESSMENT OF POTENTIAL TOXIC RELEASES FROM LEATHER INDUSTRY DYEING OPERATIONS,**  
SRI International, Menlo Park, CA.

S. B. Radding, J. L. Jones, W. R. Mabey, and N. Bohonos.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-289 790. Price codes: A04 in paper copy, A01 in microfiche. Report No. EPA-600/2-78-215, October 1978. 71 p, 4 fig, 19 tab, 12 ref, 2 append. 804642-01-2.

**Descriptors:** \*Industrial wastes, \*Tannery wastes, \*Organic wastes, \*Toxicity, \*Waste water, Dyes, Biosorption, Effluents, Dye releases, Dye concentrations, Water pollution sources, Water pollution effects, Color, Waste water treatment.

A study of the organic dyes released to the environment in the waste waters from leather dyeing processes is reported. Acid, basic, direct, and metolized dyes are the dye types used by the leather industry, with acid and direct dyes used by the leather industry, with acid and direct dyes predominating. One plant can use as many as 100 dye formulations. Over 50 dyes have been identified as being used by tanneries; 49 of these are listed with structural formulas indicating the range of materials used. Most tanneries discharge their complex effluents directly into municipal sewers. The character of these waste streams is inconsistent because tannery operations are batch mode which very daily. Little information is available concerning the fate of the dyes released to the environment. The probable discharge of dyes in waste water is estimated based on information from suppliers and tanners. The most likely mechanism for biological removal of dyes in waste water treatment systems appears to be biosorption. The tanning industry structure, its processing operations, the types of raw materials required, the potential process sources of emissions to the environment, and environmental control practices are described. (Davison-IPA) W79-03972

**INVESTIGATION OF LANDFILL LEACHATE POLLUTANT ATTENUATION BY SOILS,**  
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.

W. H. Fuller.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 995. Price codes: A11 in paper copy, A01 in microfiche. Report No. EPA-600/2-78-158, August 1978. 219 p, 41 fig, 104 tab, 91 ref, 5 append. 68-03-0208.

**Descriptors:** \*Water pollution, \*Groundwater, \*Soil chemistry, \*Leachate, \*Soil permeability, Municipal wastes, Industrial wastes, Contamination(Soil), Solid wastes, Leaching, Arsenic, Beryllium, Cadmium, Copper, Chromium, Lead, Mercury, Selenium, Zinc, Iron, Clay, Lime, Iron oxides, Total organic carbon(TOC), Chemical oxygen demand(COD).

Because of the importance of soil and earth materials in retarding or preventing movement of pollut-

## Effects Of Pollution—Group 5C

ants into groundwater, an investigation was made of the movement and retention of a variety of pollutants when they were carried by municipal solid waste leachate through soils. A laboratory study was conducted using 11 soils from 7 major orders throughout the U.S. and municipal landfill leachate alone, and spiked with pollutant metals in concentrations expected from highly polluted leachates of municipal and industrial wastes. Metals included arsenic, beryllium, cadmium, iron, mercury, nickel, lead, selenium, vanadium, and zinc. Attenuation of these substances was found to be a function of their individual properties, permeability of the soil, and the amounts of clay, lime, and hydrous iron oxides in soil. Amounts of elements retained by soils after extraction with water and 0.1 N HCl suggest that soils have substantial permanent retention capacity. Total Organic Carbon (TOC) and Chemical Oxygen Demand (COD) in unspiked leachates were not significantly retained by any soil. However, because of materials displaced from the soil, the COD in soil column effluents was initially 30 to 50 times higher than COD in the applied leachate, but rapidly decreased to the same level. TOC in soil column effluents rapidly increased to the level of TOC in the applied leachate; on subsequent leaching with water, essentially all applied TOC was eluted. Data obtained during testing were used to develop and partially validate a simulation model for predicting solute concentration changes during leachate flow through soils. (Majtenyi-IPA)

W79-03983

## A CASE STUDY OF HAZARDOUS WASTES IN CLASS I LANDFILLS

Southern California Univ., Los Angeles. Environmental Engineering Program.  
B. Eichenberger, J. R. Edwards, K. Y. Chen, and R. D. Stephens.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-284 937, Price codes: A06 in paper copy, A01 in microfiche. Report No. EPA-600/2-78-064, June 1978. 114 p., 20 fig., 44 tab., 36 ref., 5 append. R-803813.

Descriptors: \*Pollutant identification, \*Oil wastes, \*Landfills, \*Chemical wastes, Soil contamination, Water pollution sources, Industrial wastes, Liquid wastes, Municipal wastes, Los Angeles, Hazards, Metals, Water pollution, Groundwater, Surface waters, Sodium, Iron, Calcium, Zinc, Potassium, Magnesium, Copper, Chromium, Nickel, Lead, Barium, Manganese, Vanadium, Cadmium, Arsenic, Beryllium, Silver.

A total of 320 waste samples were collected from five landfill sites in the Los Angeles area, and consolidated into 99 samples representative of 17 industrial types. The sites received an estimated combined daily volume of  $2.3 \times 10^6$  l/day of hazardous wastes. The average daily deposition and partitioning of 17 metal species for all five sites were documented. The data were summarized for the six general industrial groups: petroleum, chemical, industrial cleaning, metal, food, and miscellaneous/unknown. The results indicate that copper, chromium, and zinc wastes present the greatest potential threat to groundwater and surface supplies in consideration of total mass deposition, weight percent in the soluble phase (42% to 86%) and maximum concentration levels (14,000 to 20,000 mg/l). The combined results for the five sites studied are considered to be representative of the hazardous stream generated in the greater Los Angeles area. (Davison-IPA)

W79-03984

## FACTORS INFLUENCING THE VOLATILIZATION OF MERCURY FROM SOIL

Environmental Monitoring and Support Lab., Las Vegas, NV.  
R. D. Rogers, and J. C. McFarlane.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 179, Price codes: A02 in paper copy, A01 in microfiche. Report No. EPA-600/3-78-054, May 1978. 19 p., 8 fig., 2 tab., 19 ref.

Descriptors: \*Mercury, \*Volatility, \*Soil chemistry, \*Soil microorganisms, \*Soil amendments, \*Soil physical properties, Soil texture, Evaporation, Soil sterilization, Clay loam, Loam, Microbial degradation.

The volatilization of mercury from amended soils, the rate of loss, the chemical and biological availability of mercury in soil, and whether such volatility is of a biological origin, was investigated. Two soils, a loamy sand and a silty clay loam, were amended to 1 ppm with mercuric nitrate. Volatilization ceased within one week after amendment; 20% of the mercury was lost from the silty clay loam, and 43% from the loamy sand. Steam-autoclaved sandy soil amended with mercury indicated that volatilization was the result of microbial action, and that the rate of volatilization was determined by the availability of mercury to the microbes. (Davison-IPA)

W79-03988

## FATE AND IMPACT OF PENTACHLOROPHENOL IN A FRESHWATER ECOSYSTEM

University of Southern Mississippi, Hattiesburg. Inst. of Environmental Science.  
R. H. Pierce, Jr.

Environmental Protection Agency, Report EPA 600/3-70-063 July 1978. 62 p., 28 tab., 7 fig., 41 ref.

Descriptors: \*Phenol, Toxicity, Fish kills, \*Water pollution effects, Environmental effects, Path of pollution, Biodegradation, Persistence, Sunfishes, Freshwater fish, Fish food, Laboratory tests, Ecosystem, Public health, \*Pentachlorophenol, \*Chlorinated phenols, Food chain bioaccumulation, \*Degradation products, Sublethal concentration, Freshwater ecosystems.

This investigation was undertaken to determine the fate of pentachlorophenol (PCP) that caused extensive fish kills in a freshwater lake in December 1974 and again in December 1976. The kills resulted from the accidental release of wood-treating wastes containing PCP in fuel oil. Food chain relationships were investigated in the lake and the accumulation and elimination of sublethal concentrations of dissolved PCP was studied under laboratory conditions for the bluegill (Lepomis macrochirus). The highest concentrations of PCP in fish were observed in the bile followed by liver, gills, and muscle. Lake sediment and leaf litter contained high concentrations of PCP throughout the two-year study. Studies of leaf litter from the contaminated water shed area showed it to be a source for chronic pollution of the aquatic ecosystem. The major degradation products observed were pentachloroanisole (PCP-OCH<sub>3</sub>) and the 2,3,5,6- and 2,3,4,5-tetrachlorophenol (TCP) isomers. These products were found to persist in sediment and fish along with PCP. The methyl ethers (anisoles) of both TCP isomers and the 2,3,4,6-TCP isomer were observed in some samples but the small amounts were difficult to quantitate. (EIS-Katz)

W79-03991

## DISTRIBUTION OF PHYTOPLANKTON IN NORTH CAROLINA LAKES

Nevada Univ., Las Vegas. Dept. of Biological Sciences.

For primary bibliographic entry see Field 5C.

W79-03989

## DISTRIBUTION OF PHYTOPLANKTON IN INDIANA LAKES

Nevada Univ., Las Vegas. Dept. of Biological Sciences.

For primary bibliographic entry see Field 5C.

W79-03990

## DISTRIBUTION OF PHYTOPLANKTON IN INDIANA LAKES

Nevada Univ., Las Vegas. Dept. of Biological Sciences.

For primary bibliographic entry see Field 5C.

W79-03991

## FATE OF 3,3'-DICHLOROBENZIDINE IN AQUATIC ENVIRONMENTS

Syracuse Research Corp., NY. Life Sciences Div. H. C. Sikka, H. T. Appleton, and S. Banerjee.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 526, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency, Report EPA 600/3-78-068, July 1978. 50 p., 21 tab., 5 fig., 42 ref.

Descriptors: Freshwater fish, \*Bioassay, Mortality, \*Toxicity, Sediments, Public health, Degradation (Decomposition), Sunfish, Freshwater, \*Aromatic compounds, Dyes, Pigments, Activated sludge, Aquatic environment, Aquatic microorganisms, \*Dichlorobenzidine, Environmental control.

Several aspects of the aquatic environmental fate of 3,3'-dichlorobenzidine (DCB), a suspected human carcinogen, were examined. Greater than 95% of dichlorobenzidine present was adsorbed to natural pond and lake sediments in aqueous suspensions. Only a portion of the adsorbed chemical could be extracted from the sediments, with this amount decreasing over time, suggesting chemical reaction of DCB with sediment constituents. Dichlorobenzidine was rapidly degraded by natural and artificial light in aqueous solution, with a half-life of the order of 90 seconds in natural sunlight. Monochlorobenzidine and a benzidine were found to be intermediate products of this process. In contrast, DCB appeared recalcitrant to degradation by naturally occurring aquatic microbial communities with only a minor loss of chemical detected over a 30-day incubation period. Dichlorobenzidine was rapidly bioconcentrated in bluegill sunfish, with mortality occurring prior to establishment of a chemical equilibrium between water and fish. Bioconcentration factors of 132-554 were achieved in the fish was an acid-labile conjugate of DCB. Based on these observations, chemical and physical processes, rather than biological ones, appear to be the important factors governing the fate of DCB in

## 5C. Effects Of Pollution

## ISOLATION OF A MERCURIC CHLORIDE-TOLERANT BACTERIUM AND UPTAKE OF MERCURY BY THE BACTERIUM

Gift Univ. (Japan). Dept. of Agricultural Chemistry.

H. Horitsu, M. Takagi, and M. Tomoyeda.

European Journal of Applied Microbiology and Biotechnology, Vol. 5, p. 279-290, 1978. 17 fig., 6 tab., 12 ref.

Descriptors: \*Mercury, \*Pseudomonas, \*Biological membranes, \*Tolerance, Bacteria, Electron microscope, Membrane processes, Cytological studies, Cadmium, Chromium, Copper, Heavy metals, Biochemistry, Carbohydrates, Chemical analysis, Proteins, Metabolism, Systematics, \*Bacteria, \*Mercuric chloride.

A mercuric chloride-tolerant bacterium is isolated from activated sludge and the bacterium was identified as *Pseudomonas oleovorans*. The bacterium is tolerant up to 350 ppm Hg<sup>+</sup>, 100 ppm Cd<sup>2+</sup>, 40 ppm Cr<sup>6+</sup>, and 1000 ppm Cu<sup>2+</sup>. Observation by scanning electron microscope of cells growing with mercury shows a less rigid structure of the cell surface than in the case of controls, while observation by transmission electron microscope shows many electron-dense granules in the cytoplasm of cells growing with mercury. By chemical analysis, about 80% of mercury taken up by the cells was found in the cytoplasm, and about 20% in the cell envelope fraction of the resting cells used. Mercury was found in the supernatant fluid, but not in the microsomal fraction. (EIS-Deal)

W79-03501

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

#### EFFECT OF HEXACHLOROBENZENE (HCB) ON THE ACTIVITY OF SOME ENZYMES FROM TETRAHYMENA PYRIFORMIS.

Biologische Bundesanstalt fuer Land und Forstwirtschaft, Berlin (Germany, F.R.). Inst. fuer Nichtparasitare Pflanzenkrankheiten.

F. Geike.

Bulletin of Environmental Contamination and Toxicology, Vol. 20, p. 640-646, 1978. 1 tab, 36 ref.

Descriptors: \*Enzymes, \*Toxicity, \*Protozoa, Metabolism, Cytological studies, Food chains, Chemical analysis, Path of pollutants, Biochemistry, Proteins, Organic compounds, Biological membranes, Insecticides, Chlorinated hydrocarbon pesticides, \*Hexachlorobenzene, \*Tetrahymena, Benzene hexachloride.

Tetrahymena pyriformis cultures were treated with three different levels of HCB in controlled studies. At a dose level of 0.001 ppm the activity of delta-aminolevulinate dehydratase, hexokinase, and pyruvate kinase remained unaffected but was increased for glutamic-oxaloacetic transaminase, glutamic dehydrogenase, isocitrate dehydrogenase, and malate dehydrogenase while 0.1 ppm HCB increased the activity of all enzymes studied, the only exception being glutamic-pyruvic transaminase, the activity of which was depressed by HCB exposure. A concentration of 1.0 ppm HCB depressed the activity of most of the enzymes below control values with the exception of the two mitochondrial enzymes, MDH and ICDH, studied here. (EIS-Deal)

W79-03504

#### THE EFFECT OF ENDRIN ON THE HISTOPATHOLOGICAL CHANGES IN THE LIVER OF CHANNA PUNCTATUS.

D.A.V. Coll. Muzaffaragar (India). Dept. of Zoology.

K. V. Sastry, and S. K. Sharma.

Bulletin of Environmental Contamination and Toxicology, Vol. 20, p. 674-677, 1978. 3 fig, 19 ref.

Descriptors: \*Endrin, \*Chlorinated hydrocarbon pesticides, \*Pesticide toxicity, Cytological studies, Fish physiology, Fish diseases, Animal pathology, Toxicity, Path of pollutants, Water pollution effects, Pesticide kinetics, Chemical analysis, Tissue analysis, Liver, \*Histology, \*Channa.

Treatment with endrin produced acute pathological changes in the liver of Channa punctatus. Eight hours after injection the liver was characterized by hypertrophy of hepatocytes. The toxic changes were more severe in the centrilobular area than in the perilobular area. By 24 hours there was marked hypertrophy of the hepatic cells. Cell necrosis was severe, with the cell membranes in most cells ruptured. The histopathological changes observed here are not characteristic of endrin alone. A number of organochlorine compounds are known to produce similar toxic effects. (EIS-Deal)

W79-03503

#### EFFECTS OF SOME TRACE ELEMENTS ON THE BLOOD OF KUWAIT MULLETS LIZA MACROLEPIS (SMITH).

Kuwait Inst. for Scientific Research.

M. M. Helmy, A. E. Lemke, P. G. Jacob, and B. L. Oostdam.

Journal of Experimental Marine Biology and Ecology, Vol. 34, p. 151-161, 1978. 2 tab, 62 ref.

Descriptors: \*Lead, \*Mercury, \*Copper, \*Toxicity, \*Mullets, Heavy metals, Trace elements, Bioassay, Animal pathology, Fish physiology, Chemical analysis, Bioindicators, Fish diseases, Cytological studies, Biochemistry, Tissue analysis, \*Liza, \*Histology, Hematology.

Haemopathological changes attributed to heavy metal poisoning were observed in blood smears of Liza macrolepis taken after exposure of 96 h to graded doses of copper, lead, and mercury in a flow-through marine bioassay system. In general, changes in leucocytic profile appear to be correlated with pathological changes caused by increasing copper and mercury concentrations. By contrast,

blood samples of mullets exposed to lead, showed significant polychromasia and + 1 anisocytosis regardless of concentrations. The RBC count, haemoglobin content, and haemoglobin content, and haematoctrit percentages were less valuable in diagnosis of copper and mercury effects. These manifestations of poisoning by trace elements bear a resemblance to the pathological changes that have been shown clinically and experimentally in mammals. Consequently, blood measurements on marine organisms may be diagnostic of undesirably high levels of copper and mercury, and so may constitute useful indicators of marine pollution. (EIS-Deal)

W79-03504

#### ULTRASTRUCTURAL ALTERATIONS IN THE EGGSHELL GLAND EPITHELIUM OF THE MALLARD DUCK AFTER CHRONIC EXPOSURE TO DDT.

Edgewood Arsenal, Aberdeen Proving Ground, MD. Biomedical Lab.

G. J. Kolaja, and D. E. Hinton.

Environmental Pollution, Vol. 17, p. 237-244, 1978. 5 fig, 17 ref.

Descriptors: \*DDT, \*Reproduction, \*Bird eggs, \*Mallard duck, Electron microscopy, Cytological studies, Calcium, Pesticide toxicity, Chlorinated hydrocarbon pesticides, Animal physiology, Animal pathology, Animal metabolism, Biochemistry, Biological membranes, Enzymes, Path of pollutants, Water pollution effects, \*Histology.

The effects of chronic ingestion of DDT were studied on the ultrastructure of the eggshell gland of the mallard duck. Ultrastructural changes seen were oedema of the Type II epithelium cells, as demonstrated by decreased electron density, and vacuoles in the endoplasmic reticulum. Since the Type II cells are responsible for the transport of calcium, alterations in these cells indicate that decreased calcium transport may be responsible for DDT-induced eggshell thinning. (EIS-Deal)

W79-03506

#### UREA FERTILIZATION OF NATURAL FOREST: EFFECTS ON WATER QUALITY, Laurentian Forest Research Centre, Quebec (Ontario).

A. Gonzalez, and A. P. Plamondon.

Forest Ecology and Management, Vol. 1, No. 3, November 1977, p. 213-221. 1 fig, 22 ref.

Descriptors: \*Ureas, \*Fertilization, \*Forest watersheds, \*Water pollution effects, \*Water pollution sources, \*Streams, Nutrients, Nitrogen, Montmorency Experimental Forest (Quebec-Canada), Canada, Lumbering, Fertilizers, Ammonium, Conductivity, Nitrates, Rainfall, Balsam fir trees, White spruce trees, Birch trees.

Fertilization with urea at a rate of 150 kg N/ha of a 120-ha forest watershed in Laval University's Montmorency Experimental Forest 80 km north of Quebec, Canada in June and September 1973 had no significant effect on water quality. A contiguous 120-ha watershed served as control. Only ammonium and conductivity increased significantly in stream water in the 10-15 days following application; nitrate increased slightly for a short time, and other parameters exhibited small changes. Urea was identified only at trace levels during the 48 hrs after fertilization, and only ammonium was temporarily above international drinking water guidelines. Storm intensity strongly influenced water quality response to fertilization; abundant rainfall coincided with the application. The watersheds were covered with a natural stand of 80% balsam fir, 10% white spruce, and 10% white birch. Altitude is 783-994 m, trees average 30 years old, mean terrain slope is 20%, and average precipitation is 140 cm. This type of forest represents 25% of the logging potential of Quebec Province. Samples were collected manually in a turbulent section in the lower part of the main drainage stream in each watershed. Parameters determined were DO, pH, conductivity, turbidity, color, nitrogen, organic carbon, metal cations, and filterable residues. Several factors reduce the effects of forest fertilization

on water quality, compared with agricultural fertilization. (Lynch-Wisconsin)

W79-03507

#### THE DECLINE OF LAKE PLANTS.

R. L. Stuckey.

Natural History, Vol. 87, No. 7, August-September 1978, p. 66-69.

Descriptors: \*Lakes, \*Aquatic plants, \*Put-in-Bay (OH), \*Lake Erie, \*Water pollution effects, \*Limiting factors, Macrophytes, Submerged plants, Floating plants, Turbidity, Water level fluctuations, Great Lakes, Ohio, Soil erosion, Dredging, Recreation, Succession, Dissolved oxygen, Water temperature, Islands, South Bass Island (OH), Harbors, Bays, Vallisneria americana.

Aquatic macrophytes in Put-in-Bay harbor on the north shore of Ohio's South Bass Island in western Lake Erie have declined from 40 species in 1898 to 20 in 1967-70 because of: (1) water level fluctuations; (2) increased water temperature; (3) increased turbidity from erosion, dredging, and shoreline construction; (4) decreased dissolved oxygen; and (5) increased recreation. Surveys of submerged, floating, and emerged plants were made in 1898 (Pieter's), 1934 (Tiffany), 1949 (Core), and 1967-70 (the present study). Of Pieter's 40 species, eight had disappeared by 1934, and 14 by 1949. Of the 20 remaining in 1967-70, only one (Vallisneria americana) was abundant, two were common, eight were occasional, and nine were rare. There have been few changes since 1967. Rush-like plants which lined the shore of Squaw Harbor (a section of Put-in-Bay) in 1898 were almost eliminated by 1949 due to construction of boat docks, and small colonies of seven emerged species observed along the shoreline in 1967 had disappeared by 1970 following a sudden rise in lake water level and increased boat traffic. The 13 species of submersed plants recorded for Squaw Harbor in 1949 were reduced to seven by 1967-70. By 1949 few plants were found at all in the main harbor, true also in the late 1960s. Of the 20 species no longer present in Put-in-Bay harbor, 11 occur principally in cool-water habitats primarily north of Lake Erie, while 14 of the 20 surviving species from Pieter's survey have widespread distributions. (Lynch-Wisconsin) W79-03508

#### ON THE RELATION OF ORGANOTROPHY OF MARINE UNICELLULAR ALGAE TO THE DENSITY OF THEIR EXPERIMENTAL POPULATIONS AND INDIVIDUAL WEIGHTS OF CELLS.

Institute of Biology of the Southern Seas, Sevastopol (USSR).

K. M. Khailov, Z. P. Burlakova, L. A. Lanskaya, and N. A. Lavrentyev.

Marine Science Communications, Vol. 4, No. 2, 1978, p. 153-173. 9 fig, 2 tab, 30 ref.

Descriptors: \*Organotrophy, \*Marine algae, \*Cell weight, \*Cell density, \*Organic compounds, Unicellular algae, Algae, Weight, Biomass, Plant populations, Population dynamics, Density, Cultures, Gymnodinium kavalevskii, Gymnodinium lanskaya, Prorocentrum micans, Gymnodinium fission, Peridinium trochoideum, Glenodinium foliacium, Thalassiosira, Stephanopis palmeriana, Chaetoceros affinis, Dinoflagellates, Diatoms, Glucose, Glycolic acid, Plant physiology, Pyrrophyta, Chrysophyta.

Dependence in unicellular marine algae of the specific velocity of cell accumulation of dissolved organic substances (glucose and glycolic acid) on population density and individual cell weight was investigated with axenic cultures of nine dinoflagellates and diatom species. Density and weight together are inversely related to specific velocity. Moreover, the dependence of velocity on density may be approximated by exponential equations (given in a table) where the upper index approaches 1.0; the relationship between index and weight is similar, but equation parameters have not been defined. Most studies of algae (especially regarding organotrophy) have disregarded the influence of cell concentration in seawater, which

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varies by as much as 10-10,000,000 cells/l. Data reported here show that cell densities greatly affect specific rates of organic solute consumption, and therefore data on such consumption cannot be satisfactorily interpreted without specifying population density. Species investigated were *Gymnodinium kovalevskii*, *G. lanskaya*, *Prorocentrum micans*, *Gyrodinium fission*, *Peridinium trochoideum*, *Glenodinium foliaceum*, *Thalassiosira* sp., *Stephanopis palmeriana*, and *Chaetoceros affinis*. Cultures in the logarithmic growth stage were used in the experiments, carried out in 100-ml bottles with algal densities of about 1,000-1,000,000 cells/l. Carbon-14-labelled glucose or glycolic acid were added at 0.2 mg/l. (Lynch-Wisconsin) W79-03509

THE BLUE-GREEN ALGAE KEEP COMING,  
E. F. Stoermer.

Natural History, Vol 87, No 7, August-September 1978, p 59-61.

Descriptors: \*Eutrophication, \*Great Lakes, \*Phytoplankton, \*Water pollution effects, \*Phosphorus, \*Trophic level, Oligotrophy, Lakes, Algae, \*Cyanophyta, Chlorophyta, Diatoms, Nutrients, Ecosystems, Succession, Limiting factors, Silicon, Nitrogen, Transparency, Lake Erie, Lake Superior, Zooplankton, Fish, Chrysophyta.

Increasing eutrophication of the Great Lakes is described, and mechanisms responsible for the change from diatoms to cyanophyte dominance of phytoplankton are explained. Lakes Erie and Ontario are the most seriously affected, Lake Superior the least. Physical characteristics which have affected algal populations include: (1) small drainage relative to surface area and leaching-resistant bedrock resulted in nutrient-poor waters (except for nitrogen) in the pristine lakes; (2) tremendous heat-storing capacity as a result of their great mass restricts nutrient dispersal because of the thermal bar between enriched nearshore waters and the deep water; (3) only 10,000 years old, the lakes have less-well-adapted and less-resilient biota; and (4) their location on the boundary between the northern boreal forest zone and the humid temperature region, and their east-west orientation and mineral deposits encouraged migration of settlers to the Midwest. In pristine offshore waters, diatom dominated the phytoplankton, favored by low nutrient levels, relatively cold water, and limited light in deep water. With settlement of lake shores, phosphorus loading increased, reaching into the middle of the lakes and stimulating algal growth and algal uptake of other nutrients. Silicon, needed by diatoms, was depleted and blue-green and green algae not needing silicon became dominant. Diminished nitrogen levels eventually favored cyanophytes, along able to use atmospheric nitrogen. (Lynch-Wisconsin) W79-03510

AN EXPERIMENTAL SIMULATION OF CHANGES IN DIATOM AND FLAGELLATE BLOOMS,  
British Columbia Univ., Vancouver. Inst. of Oceanography.

T. R. Parsons, P. J. Harrison, and R. Waters. Journal of Experimental Marine Biology and Ecology, Vol 32, No 3, May 1978, p 285-294. 4 fig, 22 ref.

Descriptors: \*Diatoms, \*Flagellates, \*Phytoplankton, \*Eutrophication, \*Light intensity, \*Nitrates, \*Limiting factors, \*Succession, \*CEPEX Program, \*Controlled experimental ecosystem, Nutrients, Phosphorus, Chlorophyta, Dinoflagellates, Food chains, British Columbia (Canada), Canada, Oceans, Pacific Ocean, Gonyaulax catenella, Simulation analysis.

An enclosed plastic cylinder (Controlled Experimental Ecosystem, or CEE) 23 m deep and 9.5 m diameter containing about 1300 cu m of seawater and floated in the coastal Pacific Ocean at Vancouver, British Columbia, Canada, (Cepex Project) simulated phytoplankton succession from a diatom to a flagellate bloom through control of light and nutrients. Surface waters were kept mixed, and

temperature increased from 11 C to more than 15 C during the 60-day experiment. Upwelling was varied by means of pumping from 22 m, and nutrients were added as KH<sub>2</sub>PO<sub>4</sub>, KNO<sub>3</sub>, and Na<sub>2</sub>SiO<sub>3</sub>·9H<sub>2</sub>O to raise nitrates from zero after day 5 to 0.5 microgram-at. NO<sub>3</sub>-N/l from day 5 to 30, and to over three micrograms/l by day 35. On day 38 a light shield was installed over the CEE to reduce average radiation in the top four m to 20% of the former level. Three blooms occurred: (1) a diatom bloom at the start (chlorophyll-a maximum of 10 mg/cu m); (2) a flagellate bloom after 32 days (chl-a maximum 3 mg/cu m); and (3) a diatom and flagellate bloom after 60 days (5 mg/cu m). There may exist in the ocean a diatom corridor of maximum growth leading to blooms, surrounded by a flagellate-dominated area, with both small and large cells. Diatom dominance occurs in high-nitrate environments (except when silicate is lacking). Flagellates dominate in low-light regimes, diatoms at higher light, and 'high-light' flagellates at still higher intensities. (Lynch-Wisconsin) W79-03511

STIRRING INFLUENCES THE PHYTOPLANKTON SPECIES COMPOSITION WITHIN ENCLOSED COLUMNS OF COASTAL SEA WATER,  
California Univ., San Diego, La Jolla. Inst. of Marine Resources.

R. W. Eppley, P. Koeller, and G. T. Wallace, Jr. Journal of Experimental Marine Biology and Ecology, Vol 32, No 3, May 1978, p 219-239. 8 fig, 4 tab, 30 ref. NSF IS074-04838.

Descriptors: \*Phytoplankton, \*Diatoms, \*Cell size, \*Species composition, \*Zooplankton, \*Mixing, \*CEPEX Program, \*Controlled experimental ecosystem, Stirring, Coscinodiscus, Noctiluca, Pleurobrachia, Copepods, Ctenophora, Succession, Food webs, Coasts, Nutrients, Grazing, Predation, Copper, Settling velocity, Species diversity, Saanich Inlet (BC-Canada), Canada.

Stirring of seawater in two polyethylene cylinders 16.1 m deep by 2.4 m diameter (Controlled Experimental Ecosystems, or CEEs) at Saanich Inlet, Vancouver Island, British Columbia, Canada (CEPEX Project) maintained dominance of large-celled diatoms (Coscinodiscus spp.), while in two unstirred CEEs microflagellates became dominant after 2-4 wks. Turbulent mixing of the quiescent water is needed to maintain in suspension large-celled phytoplankton with rapid sinking rates. In one CEE stirred to 15 m, large-celled species remained dominant over the entire experiment (31 August-14 October 1976), while in a CEE stirred only to 10 m phytoplankton cell diameter ultimately declined, apparently as a result of grazing pressure by herbivorous copepods (Noctiluca sp.). It is thought that in the deep-stirred CEE such grazing was prevented by predation on the copepods by the ctenophore Pleurobrachia sp.; a higher phytoplankton standing stock also resulted. Stirring to the bottom may develop equilibrium among components of the simple linear food web. Stirring resulted in net nutrient utilization ratios typical of the open sea, while in unstirred CEEs the N:P utilization ratio was high. Addition of 15 micrograms/l copper reduced copepod feeding rate but did not cause mass mortality. (Lynch-Wisconsin) W79-03512

LOWER SANTEE RIVER ENVIRONMENTAL QUALITY STUDY; AN ASSESSMENT OF SELECTED BIOLOGICAL AND PHYSICAL PARAMETERS,  
South Carolina Water Resources Commission, Columbia.

For primary bibliographic entry see Field 5B. W79-03513

CONTINUOUS SIMULATION OF NONPOINT POLLUTION,  
Ramlit Associates, Berkeley, CA.

For primary bibliographic entry see Field 5B. W79-03515

BIOLOGICAL PROBLEMS WITH THE USE OF SEA WATER FOR COOLING,  
Central Electric Generating Board, Fawley (England), Fawley Power Station.

T. Langford. Chemistry and Industry, July 16, 1977, p 612-616, 20 ref.

Descriptors: \*Water pollution effects, \*Cooling water, \*Sea water, \*Intakes structures, Screens, Corrosion, Mortality, Fish, Invertebrates, Plankton, Heated water, Discharge(Water), Sites, Design.

Biological problems associated with the use of seawater for cooling are identified as being direct problems and environmental considerations. Direct problems are mainly intake-screen blockage, condenser-tube fouling and biologically induced corrosion. Environmental considerations include intake mortalities of fish and invertebrates, plankton mortalities incurred in transit through the cooling system, and possible effects of discharged heat, biocides, corrosion products or other chemicals on life in the receiving waters. Discussion of the problems and progress made in the past few years leads to the conclusion that by careful biological investigation early in the pre-siting and pre-design stages, many of the potential problems can be identified and steps taken to minimize their occurrence and effects. (Chilton-ORNL) W79-03543

HISTOPATHOLOGICAL EFFECTS INDUCED IN MYTILUS EDULIS BY MYTILICOLA INTESTINALIS AND THE HISTOCHEMISTRY OF THE COPEPOD INTESTINAL CELLS,  
Institute for Marine Environmental Research, Plymouth (England).

M. N. Moore, D. M. Lowe, and J. M. Gee. International Council for the Exploration of the Sea, Journal Du Conseil, Vol 38, No 1, 1978, p 6-11, 2 fig, 21 ref.

Descriptors: Environmental effects, Parasitism, Temperature, \*Mussels, \*Pathology, Animal parasites, Histopathology, Cytological studies.

Epithelial cells lining the intestine and rectum of infected mussels exhibited metaplasia, the normal ciliated columnar cells being replaced by a non-ciliated cuboidal cell type. No significant differences were observed in numbers of macrophages in connective tissues of uninjected or infected mussels maintained at 10C after 12 or 81 days, but both uninfected and infected animals maintained at 22C for 12 days showed significant increases in macrophages in connective tissues. After 81 days, no significant difference could be detected in numbers of macrophages between the four groups of mussels, indicating that the animals at the higher temperature had attained a steady state after the initial response. It was concluded that the parasite had no significant effect on the basic cellular functions of the mussel. (Chilton-ORNL) W79-03544

PHYSIOLOGICAL RESPONSES OF MYTILUS EDULIS L. TO PARASITIC INFESTATION BY MYTILICOLA INTESTINALIS,  
Institute for Marine Environmental Research, Plymouth (England).

B. L. Bayne, J. M. Gee, J. T. Davey, and C. Scullard.

International Council for the Exploration of the Sea, Journal Du Conseil, Vol 38, No 1, 1978, p 12-17, 5 fig, 2 tab, 19 ref.

Descriptors: Environmental effects, \*Parasitism, Temperature, \*Mussels, Metabolism, Growth rates, Respiration, Feeding rates, Animal parasites, Thermal stress.

Physiological measurements were made on Mytilicola intestinalis infested mussels maintained at 10, 22, and 23C. Rates of oxygen consumption were significantly higher at 22 than at 10C with a mean temperature coefficient over all conditions of time and infestation level of 1.29 + -0.12. There was no significant overall effect of temperature on fil



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levels of sodium, potassium and chloride were investigated in rainbow trout. Sodium and chloride concentrations and the sodium: chloride ratio did not vary significantly. Potassium levels were significantly higher at 18C. Acclimation to higher temperatures resulted in elevation of blood carbonic anhydrase activity. Under physiologically realistic incubation temperature conditions, changes were observed in renal and branchial carbonic anhydrase activity which were modest but significant. It was concluded that branchial and renal carbonic anhydrase activities may provide relatively thermostable basal rates of sodium and chloride uptake. Augmentation of recruitment at temperatures which promote increased electrolyte depletion appears to be largely associated with increased branchial (Na<sup>+</sup>/K<sup>+</sup>) ATPase and erythrocyte carbonic anhydrase activities. (Chilton-ORNL) W79-03559

## RETARDATION OF SEDIMENT PHOSPHORUS RELEASE BY FLY ASH APPLICATION, Notre Dame Univ., IN.

T. L. Theis, and P. J. McCabe. Journal Water Pollution Control Federation, Vol. 50, No. 12, December 1978, p. 2666-2676, 8 fig, 4 tab, 21 ref. EPA R801245.

Descriptors: Environmental effects, \*Water pollution effects, Sediments, \*Phosphorus, Fly ash, Lakes, Eutrophication.

This study reports on the effects of the placement of a layer of fly ash on the sediments of a small, culturally eutrophic lake. The application brought about a reduced release of phosphorus during anoxic periods due to both physical and chemical alterations in the sediments. A sharp decrease in sediment moisture content was noted in comparison to control sediments. CDB (citrate-dithionite-bicarbonate extractable) iron and phosphorus values were reduced by an average of 37 and 44% respectively. Previous criteria for selection of fly ash for application to lake sediments have been identified as lime content and comparative specific gravity relative to the sediments to be treated. It is suggested that the CDB iron and phosphorus contents and potential for heavy metal release to the sediment environment be added to the criteria. (Chilton-ORNL) W79-03563

## ASPECTS OF ESTUARINE INTERTIDAL ECOLOGY OF JUVENILE STRIPED MULLET, MUGIL CEPHALUS, IN HAWAII, California Univ., Santa Cruz Center for Coastal Marine Studies.

P. F. Major. Fishery Bulletin, Vol. 76, No. 2, 1978, p. 299-314, 3 fig, 3 tab, ref.

Descriptors: \*Environmental effects, \*Temperature, Salinity, Fish, Distribution patterns, \*Mullet, Estuaries, \*Estuarine environment, Intertidal areas, Predation, Schools(Fish), \*Hawaii.

An experimental vertical thermal gradient was used to study the relationship between salinity and temperature and the distribution of schools of young striped mullet. Field observations were made of the distribution, feeding, and predator-prey behavior of schooled mullet. Depth and temperature distribution results taken together indicated that temperature selection was the more important factor in distribution. Fish < or = 50 mm standard length (SL) showed a predilection towards the surface whereas fish > or = 50 mm SL appeared predisposed towards the bottom before the initiation of heating or cooling. In the field, fish > or = 50 mm remained seaward of the tide of heating or cooling. In the field, fish > or = 50 mm remained seaward of the tide line in water of lower and more uniform temperature and higher and more uniform salinity than those recorded for mullet < 50 mm. The formation of large schools during all stages of life appears to be important in reducing predation and possibly also in competing with other species for food and space in estuarine intertidal region. (Chilton-ORNL) W79-03561

CHANGES IN MUSCLE PHOSPHOFRUCTOKINASE IN TEMPERATURE ACCLIMATED WINTER FLOUNDER (PSEUDOLEURONECUS AMERICANUS), Memorial Univ. of Newfoundland, St. John's. Dept. of Biochemistry, L. L. Longerich, and L. A. W. Feltham. Journal of Thermal Biology, Vol. 3, 1978, p. 61-67, 7 fig, 2 tab, 33 ref.

Descriptors: Environmental effects, \*Water pollution effects, Thermal pollution, \*Flounder, \*Temperature, Fish, Enzymes.

Flounder white muscle tissue was assayed to determine if temperature compensation could be demonstrated in these fish through a change in the activity of the allosteric enzyme phosphofructokinase (PFK) and whether this compensation was due to quantitative or qualitative changes in the enzyme. Flounder muscle PFK specific activity increased with increasing amounts of fructose-6-phosphate (F-6-P). Affinity for F-6-P was the same for fish acclimated to both OC and 15C as shown by similar  $K_m$  values. There was no evidence that PFK from the two sets of acclimated fish behave differently to any of the effectors test, however, the specific activity of muscle homogenate PFK from OC acclimated flounder was significantly higher than that of the 15C acclimated flounder. The evidence suggested that this difference is due to a quantitative change in the amount of enzyme produced in the winter flounder under different environmental temperatures. (Chilton-ORNL) W79-03563

## WORKSHOP ON COPPER IN ESTUARINE, CONTINENTAL AND MARINE WATERS.

Department of Energy, Washington, DC. Div of Biomedical and Environmental Research.

Available from the National Technical Information Service, Springfield, VA 22161 as CONF-771236, Price codes: A03 in paper copy, A01 in microfiche. CONF-771236, UC-11, April 1978. Summary of a Workshop held in San Francisco, California, December 7-8, 1977. Templeton, W.L. (Ed.) 36 p.

Descriptors: \*Conferences, Publication, Technical societies, \*Copper, \*Estuarine environment, Ecosystems, Freshwater, Sea water.

This report is the summary of a workshop held in conjunction with the Fall Meeting of the American Geophysical Union as an adjunct to the AGU sessions on Copper in Estuarine, Continental and Marine Waters. The intention of the workshop was to provide a basis for discussion and interaction by scientists. Short summaries of the four major topic areas (Analytical and Sampling Techniques, Copper/Ecosystems Interactions, Biological Availability, and Biological Uptake and Effects) which were prepared by the discussion leaders are printed in this report. Abstracts of papers presented at AGU session on Copper in Estuarine, Continental and Marine Waters are included in the report. (Chilton-ORNL) W79-03564

## PHOSPHATE INCORPORATION BY DAPHNIDS AND CHANNEL CATFISH IN PHOSPHATE-RICH ENVIRONMENTS.

Syracuse Research Corp., NY. Center for Chemical Hazards Assessment.

J. R. Strange, W. E. Kerr, P. M. Allred, and D. J. Fletcher.

Journal of Environmental Science and Health, Vol. 12, No. 7, p 311-325, 1977. 1 fig, 3 tab, 6 ref. OWRT B-088-GA (3).

Descriptors: \*Water pollution effects, \*Phosphates, \*Food chains, \*Cafishes, \*Daphnia, Radioactive wastes, Laboratory tests, Plankton, Chemical analysis, Path of pollutants, Food webs, Ecosystems, Water pollution, Phosphorus compounds.

Studies undertaken to determine the extent to which Daphnia incorporated phosphate and the extent of the bioconcentration and bioaccumulation of phosphate in channel catfish are reported. W79-03561

Three different laboratory experiments were conducted for the studies: (1) Daphnia were examined for phosphorus uptake after radiolabelled and unlabelled phosphate were introduced into the water; (2) catfish uptake was examined after the injection of radiolabelled and unlabelled phosphate into the water; (3) catfish were fed Daphnia which had incorporated phosphate, and then examined for bioaccumulation of phosphorus. The Daphnia maintained a steady level of radioactive phosphate after the slight decline in measured radioactivity. The catfish directly exposed to the radiolabelled phosphate for two weeks incorporated labelled phosphate in detectable amounts in all tissues examined. Bioconcentration was found in the heart, brain, liver, and bone; while gill, stomach, and kidney activities remained constant. Bioaccumulation studies of the phosphate incorporated Daphnia fed catfish showed bioaccumulation in the bone, gill, brain and kidney. It is concluded that Daphnia and channel catfish directly incorporate inorganic phosphate in environments with a high phosphate content. (Davison-IPA) W79-03585

## SURVEY OF BENTHIC CORAL REEF ECOSYSTEMS, FISH POPULATIONS, AND MICROMOLLUSKS IN THE VICINITY OF THE WAI'ANAЕ SEWAGE OCEAN OUTFALL, O'AHU, HAWAII - SUMMER 1975, Hawaii Univ., Honolulu. Water Resources Center. For primary bibliographic entry see Field 5E. W79-03591

## THE EFFECT OF WASTEWATER TREATMENT ON METHANOGENESIS IN A MARINE OUTFALL, California Univ., Los Angeles.

A. L. Warford, and D. R. Kosir. Journal of the Water Pollution Control Federation, Vol. 51, p 37-42, 1979. 3 fig, 2 tab, 22 ref.

Descriptors: \*Methane, \*Methane bacteria, \*Sewage treatment, Outlets, \*Outfall sewers, Waste water treatment, Sulfates, Sulfides, Organic matter, Water analysis, Chemical analysis, Sediments, Bacteria, Carbon cycle, \*Methanogenesis.

Methanogenesis in the Avalon outfall sediments of Santa Catalina Island, California, was monitored in its natural environment before and after the initiation of wastewater treatment. After treatment began, the outfall sediments were less reducing and contained less organic matter, which led to a thirty fold reduction in the rate of methane production. High concentrations of sulfide and the presence of active sulfate-reduction did not inhibit methanogenesis, contrary to the observations in lagustrine sediments. Methanogenesis was observed to recycle annually 0.13% of the organic carbon. (EIS-Dial) W79-03636

## MORTALITY PATTERNS IN TROUT (SALMO TRUTTA AND S. GAIRDNERI) EXPOSED TO AN ANIONIC DETERGENT IN RELATION TO CONCENTRATION AND MECHANISMS OF TOXIC ACTION.

Sunderland Polytechnic (England). Dept. of Biology.

P. D. Abel. Freshwater Biology, Vol. 8, p 497-503, 1978. 4 fig, 2 tab, 10 ref.

Descriptors: \*Mortality, \*Detergents, \*Rainbow trout, \*Brown trout, Toxicity, Bioassay, Path of pollutants, Organic compounds, Sulfates, Chemical analysis, Statistical methods, Fish physiology, Animal metabolism, Electron, Microscopy, Cytological studies, \*Sodium lauryl sulphate, Anionic detergent, \*Tissue analysis, \*Histology, \*Probit lines, Mortality patterns.

Histological and electron microscopical study of the gills of fish poisoned by the anionic detergent sodium lauryl sulphate indicates that the nature of the toxic action changes at a concentration of about 120 mg l<sup>-1</sup>. Toxicity tests were conducted to determine whether this change could be detected

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

in the test data, using brown trout (*Salmo trutta*) and rainbow trout (*S. gairdneri*). Toxicity curves showed no indication of the change in toxic action, but at concentrations of 120 and 130 mg l<sup>-1</sup> of sodium lauryl sulphate 'split' probit lines occurred, and the lines for 150 mg l<sup>-1</sup> consistently differed in slope from other lines. (EIS-Deal)  
W79-03637

**DYNAMIC MODEL OF NUTRIFICATION IN HUNTINGTON BAY, NEW YORK.**  
Long Island Univ., Greenvale, NY. Dept. of Marine and Environmental Science.  
For primary bibliographic entry see Field 5B.  
W79-03638

**THE EFFECTS OF MOTORWAY CONSTRUCTION ON AN URBAN STREAM.**  
Polytechnic of Central London (England).  
C. A. Extence.  
Environmental Pollution, Vol. 17, p 245-252, 1978. 2 tab, 11 ref.

Descriptors: \*Road construction, \*Sediment control, \*Streams, Sediments, Water analysis, Suspended solids, Sediment transport, Biological communities, Invertebrates, Diptera, Aquatic populations, Mollusks, Worms, Construction, Erosion control, Roads.

The physical, chemical and biological impact of discharges resulting from motorway construction is assessed in an urban stream. The direct response of different organisms to such inputs is discussed and other effects that may be associated with this type of pollution are considered. It is concluded that discharges resulting from road construction can be serious enough to warrant control measures being implemented. (EIS-Deal)  
W79-03639

**CADMIUM AND ZINC IN MUSCLE OF BLUE-GILL (LEPOMIS MACROCHIRUS) AND LARGEMOUTH BASS (MICROPTERUS SALMOIDES) FROM AN INDUSTRIALLY CONTAMINATED LAKE.**  
Purdue Univ., Lafayette, IN. Dept. of Bionucleonics.  
For primary bibliographic entry see Field 5A.  
W79-03640

**POLLUTION PROFILE OF A RIVER,**  
Bhabha Atomic Research Centre, Bombay (India).  
Health Physics Div.  
For primary bibliographic entry see Field 5B.  
W79-03641

**SURVIVAL, DURATION OF LARVAL STAGES, AND SIZE OF POST-LARVAE OF GRASS SHRIMP, PALAEMONETES PUGIO, REARED FROM KEPONE CONTAMINATED AND UNCONTAMINATED POPULATIONS IN CHESAPEAKE BAY.**  
Old Dominion Univ., Norfolk, VA. Inst. of Oceanography.  
A. J. Provenzano, Jr., K. B. Schmitz, and M. A. Boston.  
Estuaries, Vol. 1, No. 4, p 239-244, 1978. 1 fig, 3 tab, 12 ref.

Descriptors: \*Shrimp, \*Toxicity, Larval growth stage, Chemical wastes, Industrial wastes, Reproduction, Chlorinated hydrocarbon pesticides, Water chemistry, Growth stages, Water temperature, Salinity, \*Chesapeake Bay, Bioassay, \*Kepone, Tissue analysis, Survival, \*Palaemonetes.

Female grass shrimp and eggs from the James River had highest concentrations of Kepone (0.63 and 0.47 ppm, respectively) with sample from the Lafayette River at the mouth of the James River having the second highest levels (0.04 and 0.4 ppm). Concentrations in ovigerous females and eggs in the populations most distant from the James (mouth of Potomac and upper Potomac River) were at or below the limits of detectability (0.001 to 0.015 ppm). In laboratory reared postlar-

vae from each site, concentrations of Kepone were undetectable. Despite these apparent differences in Kepone concentrations in the various populations were found no significant difference in larval, larval duration, or length of post-larvae attributable to site of origin. Highly significant differences in larval duration and size of post-larvae were attributable to parental variation. (EIS-Deal)  
W79-03642

#### MERCURY BIOCONCENTRATION IN FISH: TEMPERATURE AND CONCENTRATION EFFECTS.

Northwestern Univ., Evanston, IL. Dept. of Environmental Health Engineering.  
For primary bibliographic entry see Field 5B.  
W79-03643

**EFFECTS OF THE INSECT GROWTH REGULATOR DIMILIN (TH 6040) ON LARVAL DEVELOPMENT OF TWO ESTUARINE CRABS.**  
Oslo Univ. (Norway). Zoological Museum.  
M. E. Christiansen, J. D. Costlow, Jr., and R. J. Monroe.  
Marine Biology, Vol. 50, p 29-36, 1978. 7 fig, 8 tab, 17 ref.

Descriptors: \*Crabs, \*Animal pathology, \*Pesticide toxicity, Insect control, Toxicity, Animal physiology, Animal metabolism, Mortality, Growth stages, Larval growth stage, Insecticides, Pesticide kinetics, \*Dimilin, \*Survival, \*Zoeae, \*Histology, \*Tissue analysis.

Effects of Dimilin, an insect growth regulator which interferes with the formation of the insect cuticle, were studies on the larval development of *Rhithropanopeus harrisi* and *Sesarma reticulatum* (Crustacea: Brachyura). When larvae were exposed to 0.5 (R. harrisi only), 1.3, 5.7, and 10 ppb Dimilin from hatching to the first crab stage, survival in both species decreased in relation to increased concentrations of Dimilin. Survival of R. harrisi larvae was significantly lower at 1 ppb and higher levels compared with control experiments, and in S. reticulatum a significant decrease in survival began at the 3 ppb level. At 10 ppb Dimilin, larva survived to the megalopa stage in either of the two species. When R. harrisi larvae were treated with 10 ppb Dimilin during the intermolt period of each of the 4 zoeal stages, nearly all larvae died during molting to the succeeding stage. First zoeal larvae of R. harrisi exposed to 10 ppb Dimilin at various days during the intermolt period were more sensitive to the compound late than early in the period. It is suggested that Dimilin also may interfere with the formation of the cuticle in crab larvae. (EIS-Deal)  
W79-03644

#### COMPARATIVE GROWTH, RESPIRATION AND DELAYED FEEDING ABILITIES OF LARVAL COD (GADUS MORHUA) AND HADDOCK (MELANO-GRAMMUS AEGLEFINUS) AS INFLUENCED BY TEMPERATURE DURING LABORATORY STUDIES.

National Marine Fisheries Service, Narragansett, RI. Narragansett Lab.  
G. C. Laurence.  
Marine Biology, Vol. 50, p 1-7, 1978. 4 fig, 2 tab, 29 ref.

Descriptors: \*Water temperature, \*Fish physiology, Fish reproduction, Fish behavior, Respiration, Growth rates, Feeding rates, Food habits, Larval growth stages, Fry, Mortality, Inhibition, Animal metabolism, Embryonic growth stage, \*Cod, \*Haddock.

Comparative growth and respiration were measured during the period hatching to metamorphosis for larval cod at 4, 7 and 10°C and for haddock at 4, 7 and 9°C. Growth was positively correlated with temperature for both species. Specific growth rates on a daily basis indicated good growth for the two species at the upper two temperatures and suppressed growth at 4°C. Respiration rates measured by oxygen consumption were similar for both species. Variable and elevated oxygen consumption at

4°C indicated physiological stress at that temperature. Delayed feeding abilities, feeding initiation, yolk absorption and morphological development related to first feeding ability were similar for both species at 7 and 10°C. Larvae could survive without food and still initiate feeding until 10 days after hatching at 7°C and until 8 days at 9 to 10°C. (EIS-Deal)  
W79-03645

#### VASCULAR EFFECTS OF ACETYLCHOLINE, CATECHOLAMINES AND DETERGENTS ON ISOLATED PERFUSED GILLS OF PINK SALMON, ONCORHYNCHUS GORBUSCHA, COHO SALMON, O. KISUTCH AND CHUM SALMON, O. KETA.

Messina Univ. (Italy). Inst. of General Physiology. L. Bolis, and J. C. Rankin.  
Journal of Fish Biology, Vol. 13, p 543-547, 1978. 4 fig, 14 ref.

Descriptors: \*Fish physiology, \*Pink salmon, \*Sockeye salmon, \*Chum salmon, \*Detergents, Salmon, Chemical properties, Chemical analysis, Linear Alkylate sulfonates, Toxicity, Spawning, Animal metabolism, Inhibition, \*Acetylcholine, \*Adrenaline, \*Isoprenaline, \*Vascular system, \*Tissue analysis, \*Propanolol, \*Gills.

Acetylcholine caused vasoconstriction whilst adrenaline and isoprenaline caused vasodilation in isolated perfused Pacific salmon gills. The detergent LAS produced concentration dependent vasodilation when present in the perfuse in concentrations of 0.6 to 3 mg l<sup>-1</sup>. The effect of LAS was partly blocked by propanolol suggesting the involvement of B-Adrenergic receptors. The maximum responses obtained with acetylcholine, adrenaline or LAS were all much greater in sea water or pre-spawning freshwater fish than in spawning fish. (EIS-Deal)  
W79-03646

**ACCUMULATION OF THE ORGANOPHOSPHATE BLACKFLY LARVICIDE ABATE (TEMEPHOS) IN SAROTHERODON MOSSAMBIKUS, WITH REFERENCE TO THE LARVICIDAL CONTROL OF SIMULIUM DAMNOSUM.**  
Centre for Overseas Pest Research, London (England). P. Matthiessen, and J. S. Johnson.  
Journal of Fish Biology, Vol. 13, p 575-586, 1978. 5 fig, 3 tab, 28 ref.

Descriptors: \*Larvicides, \*Organophosphorus pesticides, \*Pesticide residues, Pesticide kinetics, Absorption, Diptera, Fish physiology, Animal metabolism, Biodegradation, Water chemistry, Path of pollutants, Fish food Organisms, Toxicity, Animal parasites, Human pathology, Public health, Insecticides, Tissue analysis, Bioaccumulation, \*Temephos, \*Abate, \*Sarotherodon.

This paper describes the uptake and fate of the organophosphate larvicide Abate (temephos) in the tropical food fish, Sarotherodon mossambicus, during exposure to concentrations (nominally 0.001-0.1 mg dm<sup>-3</sup>) similar to those being produced in West African rivers by the WHO Onchocerciasis Control Programme. S. mossambicus was able to absorb Abate both directly from the surrounding water, and by contaminated food. Maximum residue concentrations were proportional to dosage and were elevated in starving fish. Internal distribution depended on tissue fat content. Some fish produced the sulfoxide metabolite, and total residues diminished slowly during recovery. (EIS-Deal)  
W79-03647

**THE EFFECT OF COPPER, HARDNESS AND PH ON THE GROWTH OF RAINBOW TROUT, SALMO GAIRDNERI.**  
Guelph Univ. (Ontario). Dept. of Zoology. K. G. Waiwood, and F. W. H. Beamish.  
Journal of Fish Biology, Vol. 13, p 591-598, 1978. 3 fig, 2 tab, 23 ref.

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## Effects Of Pollution—Group 5C

Descriptors: \*Copper, \*Hardness(Water), \*Hydrogen ion concentration, \*Growth rates, \*Rainbow trout, Fish physiology, Animal metabolism, Fish diets, Fish behavior, Inhibition, Toxicity, Copper compounds, Regression analysis, Metals, Water chemistry, Chemical analysis, Cupric ions.

Rainbow trout held at a fixed ration and activity regime were exposed to a number of copper, pH and hardness combinations. Growth rate, appetite and gross conversion efficiency were determined over three consecutive 10-day periods and partial or complete recovery was observed thereafter. For a given pH, less copper was required to reduce growth by a given amount at low than at high levels of hardness. At a given hardness, copper-induced depressions in growth rate were more pronounced and recovery slower in a low than in a high pH. No distinction could be made among total soluble or extractable copper but predicted concentrations of six specific cupric ions varied with pH and hardness. Regression analysis indicates that only  $\text{Cu}^{2+}$  and  $\text{CuOH}^+$  could be significantly correlated with growth rate. (EIS-Deal) W79-03648

## POLYCHLORINATED BIPHENYL (PCB) EFFECTS ON MARINE PHYTOPLANKTON PHOTOSYNTHESIS AND CELL DIVISION,

Stanford Univ., Pacific Grove, CA. Hopkins Marine Station.  
L. W. Harding, Jr. and J. H. Phillips, Jr.  
Marine Biology, Vol. 49, p 93-101, 1978. 3 fig, 2 tab, 50 ref.

Descriptors: \*Polychlorinated biphenyls, \*Toxicity, \*Photosynthesis, \*Phytoplankton, Marine algae, Cytological studies, Reproduction, Inhibition, Diatoms, Growth rates, Primary productivity, Aquatic populations, Chemical wastes, Chlorophyta, Water pollution effects, \*Thalassiosira, Isochrysis, \*Chaetoceros, \*Skeletonema.

Inhibition of photosynthesis and cell division by polychlorinated biphenyls (PCBs) was studied using 7 marine phytoplankton species representing 4 algal classes. PCB concentrations as low as 1.0 Micro g l<sup>-1</sup> reduced cell division of *Thalassiosira pseudonana* 3H and *Isochrysis galbana*. Both photosynthesis and cell division of *T. pseudonana* 3H, *Chaetoceros socialis*, *Skeletonema costatum*, *T. pseudonana* 13-1, *Monochrysis lutheri* and *I. galbana* were inhibited at a PCB concentration of 10.0 Micro g l<sup>-1</sup>. The effects on photosynthesis were immediate and probably resulted in reduced rates of cell division. Interspecific differences in susceptibility were observed. These differences have significance with respect to primary production and the species composition of phytoplankton communities. The initial slopes of photosynthesis-irradiance curves for the diatoms *S. costatum* and *T. pseudonana* 3H were reduced in the presence of PCBs. These results suggest that PCBs affect the photosynthetic light reactions. (EIS-Deal) W79-03654

## REGULATION OF COPPER AVAILABILITY TO PHYTOPLANKTON BY MACROMOLECULES IN LAKE WATER,

Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).

For primary bibliographic entry see Field 5B.  
W79-03651

## ROUTINE OXYGEN CONSUMPTION OF MUGIL CEPHALUS, LIZA DUMERILLI AND L. RICHARDSONI AT DIFFERENT TEMPERATURES AND SALINITIES,

Port Elizabeth Univ. (South Africa). Dept. of Zoology.

J. F. K. Marais.  
Marine Biology, Vol. 50, p 9-16, 1978. 7 fig, 2 tab, 20 ref.

Descriptors: \*Oxygen, \*Water temperature, \*Salinity, \*Mullets, Fish physiology, Animal metabolism, Fish behavior, Respiration, Diurnal, Fish

populations, Biochemical oxygen demand, \*Oxygen requirements, Starvation, Mugil, Liza.

Oxygen consumption studies were undertaken with 3 mullet species. It was found that handling had a profound influence on metabolic rate and led to considerably increased consumption rates during the first 8 h after introduction into the respiration chambers. Fasting in *L. dumieri* resulted in a total drop of 27% in oxygen consumption over a period of 6 days, of which 10% occurred over the first 24 h. Oxygen consumption displayed diurnal rhythms during the 6 day period, with lowest consumption rates at midday and midnight and highest just after sunrise and sunset. Patterns of oxygen consumption at different temperatures and salinity varied inter-specifically. (EIS-Deal) W79-03652

## DISAPPEARANCE OF AROMATIC HYDROCARBONS AND ORGANIC SULFUR COMPOUNDS FROM FISH FLESH REARED IN CRUDE OIL SUSPENSION,

Okayama Univ. (Japan). Dept. of Public Health, M. Ogata, and Y. Miyake.  
Water Research, Vol. 12, p 1041-1044, 1978. 3 fig, 1 tab, 10 ref.

Descriptors: \*Eels, Oil, \*Oil pollution, Absorption, Aromatic compounds, Organic compounds, Sulfur compounds, Animal metabolism, Fish physiology, Sea water, Gas chromatography, Chemical analysis, \*Crude oil, Tissue analysis, Bioaccumulation, \*Depuration, \*Benzene, \*Toluene, \*Xylene.

Eels (*Anguilla japonica*) were reared in sea water containing a crude oil suspension (50 ppm for 10 days for aromatic hydrocarbons, 2500 ppm for 3 days for organic sulfur compounds), then transferred to clean sea water. The disappearance of aromatic hydrocarbons and organic sulfur compounds from eel flesh was examined. Concentration ratio (concentration of eel flesh/concentration of water) of benzene, toluene, m- or p-xylene and o-xylene on 10 days is 3.5, 13.2, 23.6 and 21.4 respectively. Benzene, toluene, m- or p-xylene and o-xylene disappeared after the transfer to clean sea water, and half life period is 0.5, 1.4, 2.6 and 2.0 days respectively in first phase which lasted 0-5 days. Organic sulfur compounds in eel flesh decreased as the time spent in clean sea water increased, but were still present after 30 days. The results suggest that aromatic hydrocarbons and organic sulfur compounds could serve as markers of oil pollution in fish. (EIS-Deal) W79-03654

## THE SELECTION AND LIMITATIONS OF PHENOL AS A REFERENCE TOXICANT TO DETECT DIFFERENCES IN SENSITIVITY AMONG GROUPS OF RAINBOW TROUT (SALMO GAIRDNERI),

Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.

For primary bibliographic entry see Field 5A.  
W79-03655

## INFLUENCE OF THE POLYCHLORINATED BIPHENYL PREPARATION AROCLOR 1242 ON COLOR CHANGES OF THE FIDDLER CRAB UCA PUGILATOR,

Tulane Univ., New Orleans, LA. Dept. of Biology, S. W. Fingerman, and M. Fingerman.  
Marine Biology, Vol. 50, p 37-45, 1978. 8 fig, 1 tab, 25 ref.

Descriptors: \*Polychlorinated biphenyls, \*Crabs, \*Pesticide residues, \*Aroclors, Chemical wastes, Pesticide kinetics, Chlorinated hydrocarbon pesticides, Chemical analysis, Animal physiology, Path of pollutants, Animal metabolism, Cytological studies, Biochemistry, Pigments, \*Tissue analysis, \*Melanin, Fiddler crab, Uca.

The melanin in the melanophores of specimens of the fiddler crab, *Uca pugilator*, exposed to 2, 4, and 8 ppm solutions of the polychlorinated biphenyl (PCB) preparation, Aroclor 1242R, became less dispersed than in untreated specimens. This

effect was dose-dependent. It was probably due to the PCB itself and not to polychlorinated dibenzofurans which are contaminants of commercial PCBs. The decreased melanin dispersion appeared to be related to a decrease in the rate of release of melanin-dispersing hormone from eyestalk neuroendocrine cells into the hemolymph. Eyestalks of crabs kept for 4 days in Aroclor 1242 contained 4 times as much melanin-dispersing hormone as did control crabs. When injected into isolated legs, hemolymph from crabs exposed to Aroclor 1242 produced less melanin dispersion than did hemolymph from control crabs. Aroclor 1242 did not appear to have a direct effect on the pigment-dispersing mechanisms of the melanophores. (EIS-Deal) W79-03656

## CADMIUM UPTAKE BY RAINBOW TROUT, SALMO GAIRDNERI EGGS AND ALEVINS,

University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.

J. H. Beattie, and D. Pascoe.  
Journal of Fish Biology, Vol. 13, p 631-637, 1978. 4 tab, 21 ref.

Descriptors: \*Rainbow trout, \*Cadmium, \*Fish eggs, \*Fry, Biological membranes, Absorption, Adaptation, Fish behavior, Water chemistry, Chemical analysis, Toxicity, Heavy metals, Fish physiology, Animal metabolism, Fish diseases, Animal pathology, Bioaccumulation, Tissue analysis, \*Depuration, \*Benzene, \*Toluene, \*Xylene.

The uptake of cadmium by eggs and alevins of rainbow trout from water concentrations of between 0.01 and 50.0 mg Cd l<sup>-1</sup> was investigated. The cadmium content of eggs and alevins increased with time and with exposure concentration. Lower cadmium levels were detected in alevins than in eggs. Most of the cadmium (98%) in the eggs was found to be associated with the egg membrane or chorion. This explains the considerable reduction in cadmium concentration observed in alevins after hatching. Alevins hatching from eggs which had been exposed to cadmium survived longer in cadmium than alevins not exposed as eggs. This suggests that the pretreatment of eggs with cadmium serves some protective function. Behavioural and pathological signs of cadmium poisoning such as erratic swimming and blood clotting in alevins were observed. (EIS-Deal) W79-03657

## ENHANCEMENT OF SOCKEYE SALMON (ONCORHYNCHUS NERKA) BY LAKE FERTILIZATION IN GREAT CENTRAL LAKE: SUMMARY REPORT,

Fisheries and Marine Service, Nanaimo (British Columbia). Pacific Biological Station.

R. J. LeBrasseur, C. D. McAllister, W. E. Barracough, O. D. Kennedy, and J. Mauzer.  
Journal of the Fisheries Research Board of Canada, Vol. 39, 1978, p 1580-1596. 10 tab, 6 fig, 66 ref.

Descriptors: \*Lakes, Phosphates, Nitrates, \*Food chain, \*Sockeye salmon, Zooplankton, \*Eutrophication, Nutrients, Fertilizer, Fertilization, \*Primary production, Fish food, Organisms, Fish harvest, Fish populations, Fish production, Canada, \*Grand Central Lake(BC).

Great Central Lake was treated with ca. 100 t of commercial grade fertilizer (ammonium nitrate and ammonium phosphate) annually from 1970 through 1971. Limnological parameters and sockeye salmon juveniles and adults were monitored from 1969 through 1976 to test the hypothesis that increasing the supply of inorganic nutrients in an ultraoligotrophic lake would increase production at succeeding trophic levels. During fertilized years mean summer primary production increased fivefold, zooplankton standing stock increased 9 times, the percentage survival from estimated potential egg deposition to juvenile sockeye increased 2.6 times, while mean stock size of adult sockeye increased from <50,000 to >360,000. Adult sockeye returning to an adjacent untreated lake also increased in abundance. The data for the 8-yr

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

period support the initial hypothesis, but the dominant processes affecting production and interrelationships between different trophic levels in different years remain masked. (EIS-Katz)  
W79-03658

#### THE EFFECTS OF COAL ASH BASIN EFFLUENT AND THERMAL LOADING ON BACTERIAL POPULATIONS OF FLOWING STREAMS,

Texas Univ. Health Science Center, Houston. School of Public Health.  
R. K. Guthrie, D. S. Cherry, F. L. Singleton, and R. S. Harvey.

Environmental Pollution, Vol. 17, p 297-302, 1978. 1 fig. 1 tab. 11 ref.

Descriptors: \*Bacteria. \*Water temperature. \*Thermal pollution. Aquatic populations. Growth rates. Water quality. Trace elements. \*Thermal powerplants. Cytological studies. Biological communities. Coals. Seasonal. Water chemistry. Industrial wastes. \*Coal ash.

Water quality parameters and elemental concentrations were studied for a period of one year in an ash basin drainage systems. Measurements were made in streams heated by thermal discharge from an electric power plant and in a non-polluted reference stream. Water samples from four stations were cultured for total culturable heterotrophic bacteria in the water column, number of chromogenic colonies and total number of different colony types (diversity). Both thermal loading and large concentrations of chemical elements from the coal ash basin reduced diversity and percentage chromagens, although increasing total culturable bacteria. Temperature appeared to have a greater effect on community stability characteristics than did increased elemental concentration on the naturally occurring bacterial populations in these systems. (EIS-Deal)  
W79-03659

#### BENTHIC MACROINVERTEBRATE COMMUNITIES OF THE PENOSCOT RIVER, MAINE, WITH SPECIAL REFERENCE TO THEIR ROLE AS WATER QUALITY INDICATORS,

Maine Univ. at Orono.

For primary bibliographic entry see Field 5A.

W79-03669

#### THE EFFECTS OF SPARY IRRIGATION ON A MIXED FOREST ECOSYSTEM,

New Hampshire Univ., Durham. Dept. of Botany.

D. A. Weinstein.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 307.

Price codes: A06 in paper copy, A01 in microfiche.

MS Thesis, August 1976. 91 p. 15 fig. 15 tab. 22 ref. (OWRT A-031-NH(4), 14-31-0001-3829).

Descriptors: Mixed forests. Ecology. Sewage effluents. \*Sewage disposal. \*Waste water disposal. Groundwater contamination. Phosphorus, Potassium, \*New Hampshire. \*Ecosystems. \*Sunapee(NH). Mixed hardwood forest. Vegetation. Litter and soil components. Environmental measurements.

A mixed hardwood forest at Sunapee, N.H. receiving applications of sewage effluent, was investigated for nutrient cycling characteristics in an attempt to determine the effect of the vegetation on renovation of wastewater. Biomass and nutrient pools were determined for all major vegetative, litter, and soil components in the sprayed forest and in a nearby control. Quantities and rates of transfer between these components were also determined. Both forests have high concentrations of nutrients in leaf tissue, yet low uptake amounts for all elements except P indicating that both were absorbing nutrients to their maximum capacity before spraying. No differences in concentration or productivity existed between the forests. As a result of spraying the forest composition is changing due to a high mortality of white pine. Alteration of normal litter dynamics did not inhibit removal of N, Ca, and Mg from the percolating water. Phos-

phorus and potassium, however, are leaching through to the lower soil layers in later summer, presenting a potentially dangerous threat of groundwater contamination.

W79-03679

#### THE LANDSAT LAKE EUTROPHICATION STUDY,

Wisconsin Univ.-Madison. Dept. of Civil and Environmental Engineering.

For primary bibliographic entry see Field 7B.  
W79-03682

#### BIOLOGICAL AND ECOLOGICAL STUDIES ON THE INTERACTION OF *BDELLOVIBRIO* AND *ENTEROBACTERIACEAE*,

Auburn Univ., AL.

J. M. Westergaard.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 670. Price codes: A13 in paper copy, A01 in microfiche. Ph.D. Dissertation, 1977. 269 p. 44 fig. 66 tab. bibliography. 4 append. OWRT B-061-ALA(2).

Descriptors: \*Pathogenic bacteria. Sewage bacteria. Aquatic bacteria. Microorganisms. Sewage treatment. E. coli. \*Bdellovibrio. Coliforms. Enteric bacteria.

Water samples collected from wells, ponds, streams, wastewater oxidation lagoon systems and municipal wastewater treatment plants were examined for both *Bdellovibrio* and parameters important for the growth of *Bdellovibrio*. Municipal wastewater was the best source for isolation of *Bdellovibrio*; the organism was not isolated from well water. *Bdellovibrio* strains isolated from different aquatic ecosystems, soil and fish had a common antigen as expressed by the Complement Fixation Test and Immunodiffusion Test. Eight locally isolated *Bdellovibrio* strains had a relatively wide host range. Wastewater and 22 u pore size wastewater filtrates inoculated with equal numbers of *Escherichia coli* and of *Bdellovibrio* cells were tested at regular intervals for *Bdellovibrio* and total coliform counts during a 9-day period. *Bdellovibrio* were not isolated from fecal specimens sampled from domestic animals. It was concluded that *Bdellovibrio* was not a normal inhabitant of the intestinal microflora of animals, and that the organism could be considered a harmless bacterium for poikilothermal and homeothermal animals.

W79-03691

#### PHYTOPLANKTON NITROGEN METABOLISM, NITROGEN BUDGETS, AND OBSERVATIONS ON COPPER TOXICITY: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT,

California Univ., San Diego, La Jolla. Inst. of Marine Resources.

For primary bibliographic entry see Field 5A.

W79-03738

#### A GEOCHEMICAL STUDY OF A MARSH ENVIRONMENT,

Gulf Coast Research Lab., Ocean Springs, MS.

For primary bibliographic entry see Field 2K.  
W79-03743

#### SUMMARY OF AVAILABLE INFORMATION ON CHESAPEAKE BAY SUBMERGED VEGETATION,

Maryland Univ., Cambridge. Horn Point Environmental Lab.

For primary bibliographic entry see Field 21.

W79-03746

#### PRIMARY PRODUCTION IN THE FRESHWATER MARSH ECOSYSTEM OF TROY MEADOWS, NEW JERSEY,

Rutgers - The State Univ., New Brunswick, NJ. Dept. of Botany.

For primary bibliographic entry see Field 2H.  
W79-03758

#### PRODUCTION, NUTRIENT CONTENT AND DECOMPOSITION OF *PHRAGMITES COMMUNIS* TRIN. AND *TYPHA ANGUSTIFOLIA* L.

University of East Anglia, Norwich (England). School of Biological Sciences.

For primary bibliographic entry see Field 21.  
W79-03759

#### ROLE OF INORGANIC CARBON AVAILABILITY IN THE FORMATION OF NUISANCE BLOOMS OF BLUE-GREEN ALGAE,

Oklahoma State Univ., Stillwater. Dept. of Biological Sciences.

J. D. Ownby.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 716. Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Inst. Oklahoma State Univ. Final Tech. Comp. Rpt. 1978. 16 p. 6 fig. 14 ref. OWRT A-077-OKLA(1), 14-34-0001-8038.

Descriptors: Carbonic anhydrase. Phytoplankton. \*Cyanophyta. \*Eutrophication. \*Carbon. \*Nuisance algae. \*Carbon dioxide. \*Anabaena. \*Scenedesmus. \*Growth rates. Water pollution effects. Bioassay. Radiometric assay. Pollutant identification.

Available from inorganic carbon in the form of CO<sub>2</sub> has been suggested as a limiting factor in the growth of phytoplankton under conditions of high pH. The effects of pH and bicarbonate alkalinity on growth of the blue-green alga *Anabaena variabilis* and the green alga *Scenedesmus obliquus* were measured under laboratory conditions. Although both organisms had an initial high growth rate, *Anabaena* exhibited longer sustained growth which was enhanced by high pH and high bicarbonate alkalinity. These results appear consistent with the hypothesis that blue-green algae are better able to compete for inorganic carbon under these conditions. In the presence of bicarbonate, the growth of both algae caused an alkalization of the medium by 1.2 to 2.6 pH units, which is attributed to the uptake of bicarbonate, its conversion to CO<sub>2</sub>, and the subsequent release of OH into the growth medium. A radiometric assay was developed to measure carbonic anhydrase activity in phytoplankton. With this assay the possible role of carbonic anhydrase in the enzymatic conversion of bicarbonate to CO<sub>2</sub> in algae can be studied.

W79-03762

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W79-03762

#### EFFECTS OF POLYCHLORINATED BI-PHENYL COMPOUNDS AND PROPOSED PCB-REPLACEMENT PRODUCTS ON EMBRYO-LARVAL STAGES OF FISH AND AMPHIBIANS,

Kentucky Water Resources Research Inst., Lexington.

W. J. Birge, J. A. Black, and A. G. Westerman.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 718. Price codes: A03 in paper copy, A01 in microfiche. Research Report No. 118, 1978. 39 p. 2 fig. 12 tab. 27 ref. OWRT A-067-KY(1), 14-34-0001-7037, 14-34-0001-7038, 14-34-0001-8019.

Descriptors: \*Polychlorinated biphenyls. \*Bioassay. Embryonic growth stage. Larvae. Aroclors. Rainbow trout. Channel catfish. Goldfish. Sunfishes. Frogs. Toads. Bass. Diocetylphthalate. Diisononylphthalate. Polydimethylsiloxanes. Teratogenesis.

Static renewal bioassays were performed with four polychlorinated biphenyls including Capacitor 21 and Aroclors 1016, 1242, and 1254. Each compound was used to treat embryo-larval stages of the rainbow trout (*Salmo gairdneri*), channel catfish (*Ictalurus punctatus*), goldfish (*Carassius auratus*), redear sunfish (*Lepomis microlophus*), leopard frog (*Rana pipiens*), Fowler's toad (*Bufo fowleri*), and American toad (*Bufo americanus*). Developmental stages of the trout were the most sensitive, with LC<sub>50</sub>'s at 4 days posthatching of 0.3, 1.0, 1.1, and 1.6 micro g/l for Aroclors 1254, 1242, 1016, and Capacitor 21, respectively. LC<sub>50</sub>'s ranged between 0.009-0.011 micro g/l. Fowler's

toad was the most sensitive, with LC<sub>50</sub>'s ranging from 0.009-0.011 micro g/l. The effects of diocetylphthalate on the growth of the trout were found to be similar to those of PCB's.

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W79-03763

#### EFFECTS OF POLYCHLORINATED BI-PHENYL COMPOUNDS AND PROPOSED PCB-REPLACEMENT PRODUCTS ON EMBRYO-LARVAL STAGES OF FISH AND AMPHIBIANS,

Pennsylvania Dept. of Forest Res.

W. E. Soppo

Available from

Service, Sp

Price codes:

Inst. for Res.

Final Tech.

66 ref. appen-

0001-4205.

Descriptors: \*Municipal waste. \*Soils. \*Spray irrigation. \*Soil floor. \*Accumulation. \*Deposition. \*Capacity. Effects of sewage effluent properties on several agricultural Pennsylvania sewage effluent two phases spray irrigation the accumulation. Phase treated municipal soils of wastewater and decreases. The increased floor were a temperature interface and spray irrigation decreased in salt load soil forested areas. No effect on the mixed and corn areas no effect on (Sink-Penn W79-03766

#### THE PH AND TURE MEA

Iowa State

Plant Patho

R. B. Wildm

W. Schaub

Proceeding

192-196, 197

043-IA(2).

Descriptors: \*Indrindica, A

## Effects Of Pollution—Group 5C

toad was the most tolerant species, and LC50's varied from 3.7-28.0 micro g/l. Toxicity of the PCB's generally increased with percent chlorine substitution. Bioassays also were conducted with diisopropylphthalate (DOP), diisopropylphthalate, and Dow Corning 561 silicone, three products proposed as replacements for PCB's. Embryos and larvae of the channel catfish, redear sunfish, leopard frog, and Fowler's toad were exposed through 4 days posthatching. Catfish was the most sensitive species, and sunfish was the most resistant. Based on LC50 values, replacement products were found to be 2-5 orders of magnitude less toxic than PCB's. Continuous flow embryo-larval bioassays were performed on Capacitor 21 and DOP. Test species included redear sunfish, rainbow trout, and largemouth bass (*Micropterus salmoides*). Paralleling results from static renewal tests, flow-through data reflected a vast difference in toxicity between PCB's and potential replacements. (Huffsey-Kentucky)  
W79-03763

## EFFECTS OF SPARY IRRIGATION OF MUNICIPAL WASTEWATER ON THE PHYSICAL PROPERTIES OF THE SOIL.

Pennsylvania State Univ., University Park. School of Forest Resources.

W. E. Sopper, and J. L. Richenderfer.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 732, Price codes: A09 in paper copy, A01 in microfiche. Inst for Research on Land and Water Resources, Final Tech. Report Dec. 1978. 188 p, 12 fig, 64 tab, 66 ref, append. OWRT C-5169(No 4205)(2), 14-31-0001-4205.

Descriptors: \*Sewage effluents, \*Irrigation, \*Municipal wastes, Bulk density, Corn(Field), Red pine trees, Soils, \*Pennsylvania, Physical properties, \*Spray irrigation, \*Municipal wastewater, Forest floor, Accumulation of forest floor, Forest floor decomposition, Moisture conditions, Temperature conditions, Infiltration capacity, Capillary porosity, Mixed hardwood, Reed canarygrass, Percolation capacity, Root masses.

Effects of spray irrigation of treated municipal sewage effluent on the forest floor and physical properties of the soil were studied. Conducted on several agronomic and forested areas in Central Pennsylvania which had been irrigated with sewage effluent for 14 years, the study included two phases. Phase I investigated the effects of spray irrigation of treated municipal wastewater on the accumulation and decomposition of the forest floor. Phase II studied effects of spray irrigation of treated municipal wastewater on the physical properties of soil. Results indicated that spray irrigation of wastewater increased the decomposition rates and decreased the accumulation of the forest floor. The increased decomposition rates of the forest floor were caused by increased moisture and temperature conditions at the forest floor-mineral soil interface and narrower C/N ratio of the litter. Spray irrigation of wastewater also resulted in decreased infiltration capacities of the Hublersburg silt loam soil in the mixed hardwood and red pine forested areas and the reed canarygrass agronomic area. No effect occurred on total or capillary porosity; however, non-capillary porosity was lower in the mixed hardwood, red pine, reed canarygrass, and corn areas. Spray irrigation of wastewater had no effect on percolation capacity or bulk density. (Sink-Penn State)  
W79-03766

## INFLUENCE OF BLUE-GREEN ALGAE ON THE PH AND BUFFER CAPACITY OF CULTURE MEDIA.

Iowa State Univ., Ames. Dept. of Botany and Plant Pathology.  
R. B. Wildman, B. L. Benner, D. D. Held, and C. W. Schaeberger.

Proceeding Iowa Academy Science Vol 81 No 4 p 192-196, 1974. 7 fig, 33 ref. OWRT B-039-IA(3), B-043-IA(2).

Descriptors: Buffer capacity, Algae, *Anabaena cylindrica*, *Anacystis nidulans*, *Nostoc muscorum*.

\*Cyanophyta. Hydrogen ion concentration. Cultures.

Three strains of the blue-green algae *Anabaena cylindrica*, *Anacystis nidulans* and *Nostoc muscorum* are able to adjust the pH of culture medium from stress levels (pH 4-6) to levels favorable for growth (pH 7-10). Over a period of one week, these strains increased the buffer capacity of their media with time. The pH of maximum buffer capacity after one week was very close to the pK2 of phosphoric acid. Algae grown in a medium initially buffered with Na2CO3 shifted the pH of maximum buffer capacity from the pK of carbonic acid to that of phosphoric acid.  
W79-03772

## MICROBIOLOGY-WATERBORNE OUT-BREAKS, (LITERATURE REVIEW),

National Environmental Research Center, Cincinnati, OH.

G. F. Craun.  
Journal Water Pollution Control Federation, Vol. 46, No. 6, p. 1384-1395, June, 1974. 89 ref.

Descriptors: \*Microbiology, \*Water pollution effects, \*Diseases, Chemicals, \*Reviews, \*Bibliographies, Gastroenteritis, Typhoid, Hepatitis, Shigellosis, Salmonellosis, Amoebic meningoencephalitis, *Naegleria fowleri*, Cholera, *Draconiasis*, Leptospirosis, Schistosomiasis, Shellfish poisoning.

A review was made by Craun and McCabe of the causes of waterborne-diseases occurring in the United States during the period 1946 to 1970. There were recorded 358 outbreaks of diseases or poisoning from contaminated drinking water. Illnesses were of five major categories: gastroenteritis of unknown etiology (178 outbreaks), typhoid (53 outbreaks), infectious hepatitis (53 outbreaks), shigellosis (53 outbreaks) and salmonellosis (13 outbreaks). Seventy-one percent of the outbreaks resulted from the contamination of private, individual water systems, while 83 percent of the illness was a result of polluted community water systems. The distribution system of the community facilities was the major cause through cross-connections and back siphonage. Data indicate that waterborne diseases are on the increase during the last three decades. A slight increase in mortalities has occurred for gastritis, duodenitis, enteritis, and colitis in persons over 65, however, it is still significantly lower than was observed in the 1920's. (Leibowitz-FIRL)  
W79-03773

## CULTURAL EUTROPHICATION OF LONG LAKE, WASHINGTON,

Eastern Washington State Coll., Cheney. Dept. of Biology.

R. A. Soltero, A. F. Gasperino, and W. G. Graham.

Verhandlungen Internationale Vereinigung für Limnologie, Vol. 19, p 1778-1789, November, 1975. 5 fig, 28 ref. OWRT A-058-WASH(5).

Descriptors: \*Nutrients, Nitrate nitrogen, Orthophosphate, Density current, Primary productivity, Chlorophyll, Oxygen depletion, Phytoplankton, Zooplankton, \*Eutrophication, \*Washington, Long Lake(Wash), Water pollution effects.

Long Lake has become a popular recreational site, which has resulted in extensive development of permanent and weekend dwellings along its shores. However, in the last ten years, there has been complaints about the deterioration of the reservoir's water quality. Massive algal blooms and greater growths of aquatic macrophytes have been chief sources of concern. This investigation was undertaken to determine the trophic status of Long Lake and to correlate changes in primary production to the physical and chemical environment in the reservoir. Changes in zooplankton populations were related to changes in phytoplankton populations.  
W79-03777

## SCENARIO FOR AN ONGOING CHLOROPHYLL A SURVEILLANCE PLAN ON LAKE ONTARIO FOR NON-INTENSIVE SAMPLING YEARS.

Canada Centre for Inland Waters, Burlington (Ontario).

For primary bibliographic entry see Field 5A.  
W79-03808

## CARBON FLOW IN FOUR LAKE ECOSYSTEMS: A STRUCTURAL APPROACH,

Washington Univ., Seattle. Fisheries Research Inst.

J. E. Richey, R. C. Wissmar, A. H. Devol, G. E. Likens, and J. S. Eaton.  
Science, Vol 202, NO 4373, p 1183-1186, December 15, 1978. 2 tab, 13 ref. NSF DEB76-82283.

Descriptors: \*Lakes, \*Carbon, \*Nutrients, On-site data collections, On-site investigations, Eutrophication, Water quality, Organic compounds, Organic matter, Ecosystems, Watersheds(Basins), Forest watersheds, Urbanization, Limnology, Carbon flux.

Direct and indirect carbon fluxes in lakes Marion (British Columbia), Findley (Washington), Wingra (Wisconsin), and Mirror (New Hampshire) were compared, using budgets and input-output analysis. Overall differences in carbon flow between the lakes were shown with cycling indices of 0.031, 0.108, 0.572, and 0.661, respectively. The results suggested that lake ecosystems may be considered unique aggregations of similar components. (Sims-ISWS)  
W79-03815

## IMPACT OF NEARSHORE DEVELOPMENT ON OPEN COASTAL RESOURCES,

Southern California Coastal Water Research Project, El Segundo, CA.

A. J. Mearns and D. R. Young.  
In: Southern California Ocean Studies Consortium Technical Paper No. 1, 'The Urban Harbor Environment', 1978. Presented at the First Southern California Ocean Studies Consortium Symposium, held Long Beach, California, on 16 April 1977. p 23-48, 4 fig, 3 tab, 47 ref.

Descriptors: \*Coastal zone, \*Resources development, \*California, \*Harbors, Trace metals, Pollutant identification, Sewage effluents, \*Outer Continental Shelf, \*Nearshore environment, Chlorinated hydrocarbons.

Recent studies which are relevant to understanding the combined and separate effects of coastal and harbor activities on chemical and biological conditions along the coast of southern California are summarized. The chemical summary presents new data on the coastal distribution of trace metals, chlorinated hydrocarbons and biological accumulation of some trace contaminants. Comments on biological effects focus on the now well studied soft bottom communities at open coastal discharge sites. Previous studies, including monitoring surveys, have generally centered around descriptions of the faunal complexities at individual waste discharge sites. In this paper (1) the biological similarities among large and small coastal discharge sites, particularly those which show promise as management tools and (2) which pollutants appear to be most important in causing the kinds of effects observed around most sewage discharge sites are explored. (Sinha-OEIS)  
W79-03829

## PROCEEDINGS OF THE 1977 OIL SPILL RESPONSE WORKSHOP.

National Coastal Ecosystems Team, NSTI Station, MS.

For primary bibliographic entry see Field 5G.  
W79-03830

## STATUS AND FUTURE TRENDS IN OIL SPILLS AND IMPLICATIONS FOR THE U.S. FISH AND WILDLIFE SERVICE.

Fish and Wildlife Service, Washington, DC. Office

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

of Migratory Bird Management. For primary bibliographic entry see Field 5G. W79-03831

**NATIONAL OIL AND HAZARDOUS SUBSTANCES POLLUTION CONTINGENCY PLAN AND FEDERAL RESPONSIBILITIES**, Environmental Protection Agency, Washington, DC.

For primary bibliographic entry see Field 5G. W79-03832

**CALIFORNIA'S RESPONSE TO POLLUTION INCIDENTS**, California State Dept. of Fish and Game, Long Beach.

For primary bibliographic entry see Field 5G. W79-03833

#### FATE OF OIL IN THE SEA,

Skidaway Inst. of Oceanography, Savannah, GA. R. F. Lee.

In: Proceedings of the 1977 Oil Spill Response Workshop, held Metairie, LA on 15-17 February 1977. Fish and Wildlife Service Biological Services Program Publication No. FWS/OBS/77-24, September 1977, p 43-54, 2 fig, 52 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Water pollution effects, \*Biodegradation, Coasts, Estuaries, Sediments, Weathering, Microbial degradation, Water quality control, \*Outer Continental Shelf.

The fate of oil spills at sea depends on the composition of the oil, as well as such external factors as light and temperature. The extent of degradation also depends on the type of coastal area in which the spill occurs. In open, exposed coastline areas, with good circulation of water, most fractions of spilled oil are soon degraded. In protected shallow areas with less circulation, spilled oil is incorporated into sediments and much of it remains unaltered for many years. Photo-oxidation, dissolution, emulsification, adsorption to particles, biodegradation, and uptake by marine animals are not processes that act independently, but the interactions of all of these determine the fate of oil in water. The various filter feeders, grazers, and deposit feeders of the meiofauna and macrofauna utilize the organic matter of the sediment. In this process, they may expose deeper sediments to the water sediment interface where there is more microbial activity. The involvement of both microbes and animals in hydrocarbon degradation in marine sediments may be similar to their symbiotic association in recycling organic material in terrestrial sediments. (See also W79-03830)(Sinha-OEIS) W79-03835

#### ASSESSING THE BIOLOGICAL IMPACT OF OIL SPILLS: A NEW ROLE FOR EPA BIOLOGISTS

Environmental Protection Agency Edison, NJ. R. J. Nadeau.

In: Proceedings of the 1977 Oil Spill Response Workshop, held Metairie, LA on 15-17 February 1977. Fish and Wildlife Service Biological Services Program Publication No. FWS/OBS/77-24, September 1977, p 55-60.

Descriptors: \*Oil spills, \*Environmental effects, \*Water pollution effects, \*Oil pollution, Biota, Ecosystems, Mortality, \*Outer Continental Shelf.

The effect that an oil spill has on aquatic ecosystems is influenced by a number of factors: type of oil spilled and volume, hydrography of the oil spill area, climatic and seasonal changes, indigenous biota, treatment methods used during the cleanup, and previous exposure to the spill area to oil pollution. Some of the specific effects that oil has on living systems or populations include but are not necessarily limited to, the following: death as a result of coating and asphyxiation; death through contact poisoning, death from exposure to water-soluble toxic compounds; destruction of sensitive juvenile forms; destructions of food sources or support populations, incorporation of sublethal

amounts, resulting in the reduced resistance of species to infection or stresses; and incorporation of sublethal amounts, producing an off-flavor or taint in exploitable species, thereby causing an economic loss to man. (See also W79-03830)(Sinha-OEIS) W79-03836

#### EFFECTS OF OIL ON AQUATIC BIRDS,

Fish and Wildlife Service, Laurel MD. Patuxent Wildlife Research Center. P. H. Albers.

In: Proceedings of the 1977 Oil Spill Response Workshop, held Matairia, LA on 15-17 February 1977. Fish and Wildlife Service Biological Services Program Publication NO FWS/OBS/77-24, September 1977, p 61-68, 3 tab, 24 ref.

Descriptors: \*Oil petroleum, \*Birds, \*Water pollution effects, \*Environmental effects, Ecosystems, Mortality, Analytical techniques, \*Outer continental shelf, \*Sublethal effects, Seabirds.

There is some evidence of the impact of direct mortality from oil spills on bird populations, but very little is known about the sublethal and indirect effects of oil on birds. Research at the Patuxent Wildlife Research Center, Laurel, Maryland, is directed at (1) determining the effects of petroleum on the physiology and reproductive success of birds, and (2) developing the analytical methodology necessary for detection of petroleum in avian tissues. (See also W79-03830) (Sinha-OEIS) W79-03837

#### CONTAINMENT AND RECOVERY TECHNIQUES FOR SPILLED OIL IN THE MARINE ENVIRONMENT,

National Coastal Ecosystems Team, NSTL Station, MS.

For primary bibliographic entry see Field 5G. W79-03838

#### CHEMICAL OIL DISPERSING AGENTS AND THEIR FEASIBILITY FOR USE,

Exxon Research and Engineering Co., Florham Park, NJ.

For primary bibliographic entry see Field 5G. W79-03839

#### RESTORATION OF OIL-CONTAMINATED SHORELINES,

URS Co., San Mateo, CA.

For primary bibliographic entry see Field 5G. W79-03840

**SYMPOSIUM: EXPERIMENTAL USE OF ALGAL CULTURES IN LIMNOLOGY; SANDEFJORD, NORWAY, 26-28 OCTOBER 1976**, Internationale Vereinigung fuer Theoretische und Angewandte Limnologie, Stuttgart (Germany, F.R.).

Internationale Vereinigung fuer Theoretische und Angewandte Limnologie, Mittelungen No 21, Stuttgart, June 1978. 607 p. \$40.00.

Descriptors: \*Cultures, \*Phytoplankton, \*Limnology, \*Algae, \*Testing procedures, \*Bioassay, \*Limiting factors, Nutrients, Phosphorus, Nitrogen, Phosphates, Light intensity, Poisons, Toxicity, Culture media, Selenastrum capricornutum, Eutrophication, Water pollution effects, Laboratory tests, Methodology, Analytical techniques, Lakes, Plant growth, Growth rates, Bottles test, Pollutants, Absorption, Model studies, Succession, Algal growth potential, Water chemistry.

Fifty-two papers include an introductory presentation, eight papers on methods, 17 on algal physiology, and 26 on applications. Rodhe in 1948 demonstrated the value of experimental cultures in studying the environmental requirements of algae. In 1960-62 the chlorophyte *Selenastrum capricornutum*, discovered in 1913, was evaluated experimentally as a bioassay test organism, and in succeeding years was increasingly adopted in such studies, notably those assessing effects of toxic substances

and nutrient enrichment. In 1971 it was established as a routine test organism in EPA's algal assay bottle test, and algal assays have become an important method of evaluating water quality. Several papers discuss testing techniques, including batch, continuous, and semicontinuous cultures, the bottle test, turbidostats, and chemostats. Numerous papers report experimental results on limiting nutrients, nutrient stimulation of algal growth, and growth inhibition by toxic substances. Other subjects include nutrient uptake kinetics, phytoplankton growth cycles, light limitation, mathematical models, lipid surface films, bioaccumulation, bioavailability of nutrients, hot spring algae, pigments, ecology, competition, zooplankton, succession, and growth regulators. (See W79-03843 thru W79-03849) (Lynch-Wisconsin) W79-03842

**ALGAE IN CULTURE AND NATURE**, Uppsala Univ. (Sweden). Inst. of Limnology. W. Rodhe.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung fuer Theoretische und Angewandte Limnologie, Mittelungen No 21, June 1978, p 7-20. 1 fig, 5 tab.

Descriptors: \*Algae, \*Cultures, \*Nutrients, \*Phytoplankton, \*Culture media, \*Plant growth, Selenastrum capricornutum, Lakes, Limnology, Laboratory tests, Methodology, Laboratory equipment, Testing procedures, PAAP medium, Z8 medium, Limiting factors, Eutrophication, Bioassay.

The history of efforts to create artificial culture media of algae is reviewed in brief, and nutritional aspects of freshwater planktonic algal cultures is discussed. Three tables compare the algal cultures of Beijerinck (1988), Chu 10 (1942), Rodhe VIII (1948), and Provasoli and Pinter for *Synura* (1953) with representative lake water composition (derived from world average data). In most freshwater, four cations (calcium, magnesium, sodium, and potassium) and three anions (chloride, sulfate, and  $\text{HCO}_3^-$ ) constitute close to 100% of the total ionic content. In composing synthetic media, concentrations of growth-limiting nutrients are raised over natural levels and surplus constituents are reduced, since in algal cultures higher growth rates than in nature are usually desired. The two major culture media for the common test alga, *Selenastrum capricornutum*, are described: (1) Skulberg's Z8, and (2) the PAAP (formerly ASM) medium developed by the Division of Applied Biology in Ottawa, Canada. The two media contain virtually no common denominator of nutritional significance. Though the concept of a single limiting factor and Liebig's Law of the Minimum have been shown to be inaccurate, the correct concept of several interdependent growth factors is still not universally applied. (See also W79-03842) (Lynch-Wisconsin) W79-03843

**ALGAL ASSAY PROCEDURE WITH ONE OR FIVE SPECIES. MINITEST**, Uppsala Univ. (Sweden). Algal Assay Lab. For primary bibliographic entry see Field 5A. W79-03844

**THE CULTURE COLLECTION POINT OF VIEW**, Culture Centre of Algae and Protozoa, Cambridge (England). For primary bibliographic entry see Field 5A. W79-03845

**PHYSIOLOGICAL INDICATORS OF NUTRIENT DEFICIENCY IN ALGAE**, Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst. For primary bibliographic entry see Field 5A. W79-03846

**A MODIFIED TURBIDOSTATIC SYSTEM FOR ALGAL POPULATION STUDIES**.

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W79-03847

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## Effects Of Pollution—Group 5C

Euratom European Community, Varese (Italy). For primary bibliographic entry see Field 5A. W79-03847

**SOLUBILIZATION OF BIOLOGICALLY AVAILABLE PHOSPHORUS BY AUTOCLAVING SELENASTRUM,**  
FMC Corp., Princeton, NJ. Research and Development Dept. For primary bibliographic entry see Field 5A. W79-03848

**CULTURES OF CLADOPHORACEAE IN WATER POLLUTION PROBLEMS,**  
Zurich Univ. (Switzerland). Pflanzenbiologisches Inst. For primary bibliographic entry see Field 5A. W79-03849

**COMPARISON OF BIOASSAY PROCEDURES FOR GROWTH-LIMITING NUTRIENTS IN THE LAURENTIAN GREAT LAKES,**  
Michigan Univ., Ann Arbor. Great Lakes Research Div. For primary bibliographic entry see Field 5A. W79-03850

**PRINCIPAL ASPECTS CONCERNING THE BATCH TECHNIQUE IN ALGAL ASSAYS,**  
Copenhagen Univ. (Denmark). Freshwater Biological Lab. For primary bibliographic entry see Field 5A. W79-03851

**GROWTH OF OSCILLATORIA AGARDHII IN CHEMOSTAT CULTURE. 2. DEPENDENCE OF GROWTH CONSTANTS ON TEMPERATURE,**  
Uppsala Univ. (Sweden). Inst. of Limnology. For primary bibliographic entry see Field 5A. W79-03852

**THE EFFECTS OF SOME METALLIC IONS ON THE GROWTH OF CHLAMYDOMONAS VARIABILIS AND EUGLENA GRACILIS,**  
Paris-11 Univ. (France). J. Bonaly, A. Delacourt, and J. C. Mestre. In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mittelungen No 21, June 1978, p 103-109. 5 fig. 1 tab. 5 ref.

Descriptors: \*Chlamydomonas variabilis, \*Euglena gracilis, \*Ions, \*Heavy metals, \*Growth rates, \*Toxicity, Plant growth, Algae, Phytoplankton, Lethal limit, Water pollution effects, Salts, Mercury, Cadmium, Chromium, Copper, Chlorophyta, Water quality standards.

The toxicity threshold of concentrations of various metallic ions was determined for two phytoplankters, Chlamydomonas variabilis and Euglena gracilis. The ions, including mercury (+ +), cadmium (+ +), chromium (6 +), and copper (2 +), were added to flasks containing 50 ml of axenic algal suspension, placed in a phototrophic basin with temperature fixed at 23°C and continuous illumination at 5200 lux fluorescent light, and agitated at 80/min. Cell growth was determined by daily cell counting with a Cytograf 6301 or Coulter counter. Two types of toxic action could be distinguished in sublethal concentrations: (1) With mercury and chromium (6 +) the growth curve gradient was not affected and, on the contrary, sublethal concentrations gave rise to a log-phase at the beginning of growth, the length of which varied directly with the level of the toxic substance; toxic threshold varied inversely with cell number/ml. (2) The decrease of the cellular mitosis rate was proportional to the toxic concentration, resulting in a correlative decrease of the curve gradient in its exponential phase. The distinction between these two actions should not be overemphasized. The mechanism of toxicity were very low diverse and complex. A compound's toxic threshold is directly dependent on initial algal concentration, which

must be kept in mind when setting water pollution standards. (See also W79-03842) (Lynch-Wisconsin) W79-03853

**THE EFFECT OF SEWAGE (MECHANICALLY, BIOLOGICALLY, AND CHEMICALLY TREATED) ON ALGAL GROWTH,**  
Vandkvalitetsinstitut, Hoersholm (Denmark). E. Gargas.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mittelungen No 21, June 1978, p 110-124. 7 fig, 6 tab, 8 ref.

Descriptors: \*Guden River(Denmark), \*Phytoplankton, \*Sewage treatment, \*Biological treatment, \*Mechanical treatment, \*Chemical treatment, Denmark, Lake Brass(Denmark), Lake Silkeborg Lang(Denmark), Secchi disks, Chlorophyll, Laboratory equipment, Growth rates, Plant growth, Water pollution effects, Eutrophication, Phosphorus, Batch cultures, Bioassay, Nutrients, Algae, Rivers, Lakes, Selenastrum capricornutum, Chlorophyta.

In-situ and laboratory batch algal assay experiments were carried out to determine effects of various types of sewage treatment on algal growth in the River Guden system, Denmark. The River Guden flows from Lake Brass through the eastern part of Lake Silkeborg Lang, where it receives primary treated sewage from the Soholt treatment plant. Since sewage treatment (90% chemically-based) would only marginally increase Secchi depth, due to phosphorus inputs from sources other than the treatment plant. Total nutrient loading must be reduced to significantly improve water quality in the lake. In laboratory experiments, Selenastrum capricornutum was tested in water from Lake Brass, to which mechanically or biologically/chemically treated sewage was added at different concentrations. Field measurements were carried out in Lake Brass in 300-liter polyethylene bags filled with untreated lake water to which sewage was added. In laboratory tests, sewage loadings caused an increase in potential production; algal biomass increased with increasing sewage loadings, particularly when water was spiked with mechanically treated sewage. During field tests it was not possible to estimate the effect of sewage loadings on natural phytoplankton population growth. Effects of 0%, 5%, and 10% loading of mechanically or biologically/chemically treated sewage on Secchi depth in the two lakes is given. (See also W79-03842) (Lynch-Wisconsin) W79-03854

**ON THE KINETICS OF LIGHT-LIMITED GROWTH OF SCENEDESMUS PROTUBERANS FRITSCH AND ECOLOGICAL IMPLICATIONS,**  
Amsterdam Univ. (Netherlands). Lab. for Microbiology.

H. J. Gons, and L. R. Mur. In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mittelungen No 21, June 1978, p 125-135. 5 fig, 1 tab, 13 ref.

Descriptors: \*Scenedesmus protuberans, \*Kinetics, \*Light intensity, \*Growth rates, \*Limiting factors, \*Plant growth, Temperature, Algae, Phytoplankton, Ecology, Monod equation, Photoperiodism, Batch cultures, Photospiration, Absorption, Chlorophyta.

The growth of the chlorophyte Scenedesmus protuberans in light-limiting conditions was studied in continuous cultures, and the relationship between specific growth rate ( $\mu$ ) and light intensity ( $I$ ) in dilute suspensions was measured. The relationship between  $\mu$  and the specific light uptake rate ( $dE/dI \cdot X$ ) was biphasic and linear at both 20 and 28°C at low light intensities; at high light intensities additional phases were distinguished. The phases

are: (1) a linear relationship at low light intensity and uptake rate, (2) the onset of photospiration at a certain light intensity (dependent on temperature), (3) attainment of full physiological potential at which point further increase of light intensity has no further effect, and (4) the point at which light becomes damaging and growth is inhibited. An improved light irradiance measurement method developed subsequent to presentation showed that average light intensities and specific light uptake rates were underestimated by a magnitude of three; qualitative conclusions are nevertheless unaffected. One-liter cultures in cylindrical double-walled Pyrex vessels were illuminated by circular fluorescent lamps on a light-dark cycle of 16 and 8 hours. Average light intensity was determined by measurement of light intensity in empty vessels (with water between the walls) at fixed points on the inner surface. (See also W79-03842) (Lynch-Wisconsin) W79-03855

**GROWTH CYCLE OF A FRESHWATER DIATOM,**  
Miliostyrelsen, Silkeborg (Denmark). Freshwater Lab.

C. Hunding.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mittelungen No 21, June 1978, p 136-146. 6 fig, 24 ref.

Descriptors: \*Nitzschia palea, \*Diatoms, \*Biorhythms, \*Photosynthesis, \*Photoperiodism, \*Growth stages, \*Light intensity, Life cycles, Algae, Periphyton, Plant growth, Light, Cell number, Cell volume, Microalgae, Darkness, Growth rates, Semicontinuous cultures, Limnology, Chrysophyta.

The growth cycle of the freshwater periphytic diatom Nitzschia palea was studied in semicontinuous laboratory culture to illustrate some aspects of their behavior as a natural population and to determine the precise sequence of events when cells are cultured in alternating light and dark periods of 12 hours each. Microalgae tend to be synchronized in their cell development under natural light regimens, and significant diurnal variations in such cell characteristics as the rate of photosynthesis, increase in cell number and cell volume, and chlorophyll-a concentration may be expected to occur in natural populations. The findings are important to pollution studies, since the microalgae apparently are more sensitive to various stress factors at some stages of their life cycles than at others. The light-dark growth cycle induced a periodicity in the algal culture. The increase rate of cell particle number was 3.3/day, with two distinct periods of increased growth rate: (1) beginning about seven hours after the start of the light period, and (2) beginning about four hours after the start of the dark period. The average size of cell particles decreased during periods of high growth rates, while the size range increased. At the onset of light the algal population consisted almost exclusively of small cells. Photosynthetic rate increased exponentially during early light, but was significantly reduced when cells sampled at the beginning of dark were exposed to a high quantum flux. (See also W79-03842) (Lynch-Wisconsin) W79-03856

**NUTRIENT KINETICS OF FRESHWATER PLANKTONIC ALGAE USING BATCH AND SEMICONTINUOUS METHODS,**  
Michigan Univ., Ann Arbor. Div. of Biological Sciences.

For primary bibliographic entry see Field 5A. W79-03857

**LIGHT-LIMITED CULTURES OF THE BLUE-GREEN ALGA OSCILLATORIA AGARDHII,**  
Amsterdam Univ. (Netherlands). Lab. for Microbiology.

L. Van Liere, and L. R. Mur.

In: Symposium: Experimental Use of Algal Cul-

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

## Group 5C—Effects Of Pollution

tures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No 21, June 1978, p 158-167. 7 fig, 3 tab, 10 ref.

Descriptors: \*Oscillatoria agardhii, \*Phytoplankton, \*Light intensity, \*Limiting factors, \*Plant growth, \*Growth rates, Algae, Cyanophyta, Light, Cultures, Batch cultures, Chemostats, Succession, Eutrophication, Scenedesmus protuberans, Lakes, Model studies, Mathematical models, Kinetics, Energy budget, Equations.

Cultures of the cyanophyte *Oscillatoria agardhii* were grown under light-limiting conditions to study growth kinetics, in part to permit comparison with kinetics of the chlorophyte *Scenedesmus protuberans* to explain the succession of green to blue-green algae in eutrophic lakes. A model developed by Gons and Mur (1975) to describe growth in light-limited conditions was used:  $(dE/dt)c = \mu_0 X + (\mu_0 - \mu_m)c$ , where  $dE/dt$  is the absorbed light energy,  $c$  is the efficiency factor,  $X$  is biomass,  $\mu_0$  is the specific growth rate constant, and  $\mu_m$  is the specific maintenance rate constant. In batch cultures, three surface light intensities were tested with fluorescent illumination: 0.5, 2.5, and 4.8 W/sq m. Maximal cell density increased sharply with light intensity up to 2.5 W/sq m, at which point the slope of the curve flattened. However, the energy absorbed per unit dry weight increased linearly with light intensity, leading to the conclusion that more energy per unit dry weight is needed at higher light intensities, which may have an effect on  $\mu_m$  when  $c$  is a constant. In chemostat experiments, especially at high light intensity, changes in light intensity, temperature, pH, and dilution rate sometimes had persistent traumatic effects. Processes which decrease efficiency ( $c$ ), such as photorespiration and spillage of ATP or reductants, are dependent not only on growth rate, but also on the time cell is exposed to light. High light intensity repressed pigment synthesis. (See also W79-03842) (Lynch-Wisconsin) W79-03858

## SELENIUM AS A MICRONUTRIENT FOR THE DINOFLAGELLATE PERIDINUM CINCTUM FA. WESTII,

Uppsala Univ. (Sweden). Inst. of Limnology, K. Lindstrom, and W. Rodhe.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No 21, June 1978, p 168-173. 4 fig, 1 tab, 1 ref.

Descriptors: \*Peridinium cinctum fa. westii, \*Dinoflagellates, \*Selenium, \*Nutrients, \*Plant growth, \*Culture media, \*Limiting factors, Phytoplankton, Algae, Lake Kinneret (Israel), Israel, Lake Erken (Sweden), Sweden, Micronutrients, Bioassay, Testing procedures, Methodology, Photosynthesis, Growth rates, Lakes, Pyrophyta.

Discovery of selenium as the essential growth factor in water of Lake Kinneret, Israel enabled the first successful culture of the dinoflagellate *Peridinium cinctum* fa. westii by Carefoot (1968) in a medium supplemented with vitamins, trace metals, and water from the lake. Using an entirely mineral medium (Lindstrom no. 9), a maximum specific growth rate of 0.16 was reached at 50 ng Se/l, giving a half-saturation constant ( $K_{1/2}$ ) of 7.5 ng Se/l. Increase of cell numbers in the Lindstrom no. 9 synthetic medium was comparable to the Carefoot medium with water from Lake Erken, Sweden. More than 15,000 cells/ml was attained after 58 days, while controls without selenium failed to yield significant cell numbers. Addition of selenium to Lake Erken water at 158 ng/l almost tripled the yield after 69 days, indicating that, in addition to being an indispensable constituent of Peridinium, selenium may limit its production in nature. When other nutrients were in surplus, selenium concentration was the exclusive determinant of the production of living cells, final cell yields as empty shells, and rates of oxygen production. Selenium also determined gross phyto-

synthetic oxygen production which exceeded 600  $\mu\text{g O}_2/\text{cell}/\text{hr}$  at selenium concentrations over 30 ng/l. A bioassay procedure is described which permits determination of selenium concentrations in lake water down to about 5 ng/l. It is believed that the primary effect of selenium for this alga is enzymatic. (See also W79-03842) (Lynch-Wisconsin) W79-03859

## THE MECHANISMS OF CARBON DIOXIDE FIXATION IN PHYTOPLANKTON,

Bigelow Lab. for Ocean Sciences, West Boothbay Harbor, ME.

J. Morris, J. Beardall, and D. Mukerji.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No 21, June 1978, p 174-183. 3 fig, 4 tab, 21 ref. NSF DES 75-15104, DES 75-22128.

Descriptors: \*Phytoplankton, \*Carbon dioxide, \*Photosynthesis, \*Pathways, \*Phaeodactylum tricornutum, \*Skeletonema costatum, \*Dunaliella tertiolecta, Carbon, Marine algae, Diatoms, Flagellates, Chlorophyta, Algae, Primary productivity, Carbon radioisotopes, Metabolism, Carboxylases, Tracers, Bicarbonates, Ions, Fixation.

Three marine algae, *Skeletonema costatum*, *Phaeodactylum tricornutum*, and *Dunaliella tertiolecta*, were used to study the path of carbon assimilation during photosynthesis, specifically: (1) the short-term pattern of C14-carbon dioxide fixation, (2) activities of carboxylases in cultures of marine algae, (3) correlation between changing photosynthetic rates and carboxylase activities, and (4) carbon dioxide species used by carboxylases. The mechanism of photosynthetic carbon dioxide assimilation in some marine algae differs from that generally assumed to operate in algae. Certain conclusions are suggested by the fact that the central features of the short-term pattern of carbon dioxide fixation correlate with the relative activities of RuDP Case/PEP Case, and that these features vary among algae and with the physiological state of the cells: (1) Under certain conditions some marine algae (especially diatoms) fix the bicarbonate ion through an active PEP Case; the C3 acceptor for this fixation is regenerated by a decarboxylation reaction which provides carbon dioxide for fixation by the RuDP Case of the Calvin cycle. (2) Under other conditions certain marine algae (especially green flagellates) fix carbon dioxide directly by the RuDP Case with quantitatively less fixation occurring by the PEP Case reaction. The ability of an alga to regulate a switch from a C3 mechanism to a C4 mechanism of CO2 fixation under changing environmental conditions might be important in species selection among phytoplankton populations. (See also W79-03842) (Lynch-Wisconsin) W79-03860

## PHOSPHORUS KINETICS—ALGAL GROWTH RELATIONSHIPS IN BATCH CULTURES,

Toronto Univ. (Ontario).

C. Nalewajko, and D. R. S. Lean.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No 21, June 1978, p 184-192. 5 fig, 2 tab, 15 ref.

Descriptors: \*Batch cultures, \*Phosphorus, \*Kinetics, \*Phytoplankton, \*Plant growth, \*Testing procedures, \*Perturbation experiments, \*Steady-state experiments, Growth rates, Algae, Absorption, Phosphates, Nutrients, *Anabaena flos-aquae*, *Scenedesmus quadricauda*, *Navicula pelliculosa*, Nutrient flux, Cyanophyta, Chlorophyta.

Axenic cultures of *Anabaena flos-aquae*, *Navicula pelliculosa*, and *Scenedesmus quadricauda* were used as inocula for batch cultures to: (1) ascertain if phosphate exchange between algal cells and the medium was as important as earlier work suggested, and (2) to compare the perturbation and steady-state approaches to phosphate uptake kinetics.

Data confirm that phosphate movement is not a one-way entry from medium to algal cells, but rather an exchange, and even during early logarithmic growth the influx may greatly exceed net phosphate uptake. In contrast to the earlier study, the same culture was used to follow net uptake and influx of phosphate. Turnover times of the phosphate pool in the medium were not as short as reported previously. The shortest turnover time (28.6 min) was detected in the *Anabaena* culture on the sixth day of growth, compared to 2.7 min for that species in the earlier study. A possible explanation is that experimental duration in the present study was not as long as in the earlier one and therefore phosphate limitation was not as severe. Although phosphate turnover times in the cultures do not approach the fastest lake water values, it is still concluded that algae as well as (or rather than) bacteria are responsible for the fast phosphate uptake in lakes.  $K_{1/2}$  sub  $V$  values for the three species ranged from 10-400 micrograms PO4-P/l and increased markedly during growth as phosphate depletion occurred.  $V$  sub  $M$  mass decreased with increasing growth rate and with increasing cell phosphorus content. (See also W79-03842) (Lynch-Wisconsin) W79-03861

## A MATHEMATICAL MODEL FOR GROWTH OF PHYTOPLANKTON,

Novo Industri A/S, Bagsværd (Denmark).

N. Nyholm.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No 21, June 1978, p 193-206. 2 fig, 4 tab, 27 ref.

Descriptors: \*Phytoplankton, \*Mathematical models, \*Kinetics, \*Eutrophication, \*Lakes, \*Plant growth, Algae, Denmark, Shallow water, Biomass, Dry weight, Nutrients, Phosphorus, Nitrogen, Limiting factors, Growth rates, Forecasting, Depth, Water temperatures.

A kinetic phytoplankton growth model is presented as a submodel for predicting eutrophication of receiving waters in a shallow pond, using data from the Guden River system, Denmark. Currently in use at Denmark's Water Quality Institute, the model has proved useful for simulating algal growth in several shallow, eutrophic lakes. The model treats phytoplankton as a single unit and ignores individual species. Growth is described as average growth of biomass dry weight; the model does not account for diurnal rhythms. Phosphorus and nitrogen alone are potential limiting nutrients. Specific growth rate at a particular depth is expressed as a function of light intensity, day length, temperature, and intracellular concentrations of nitrogen and phosphorus. Under limiting conditions instantaneous nutrient uptake is assumed, while in the transition regime the uptake rate is assumed proportional to the extracellular substrate concentration, and with conditions of surplus nutrients, nutrient uptake is proportional to growth of biomass. A logic incorporated into the model ensures no discontinuities during integration of the material balance equations. The dynamic description of nutrient dependence makes it possible to predict that a large algal standing crop can develop and maintain a comparatively high production rate in an environment of very low dissolved nutrients. (See also W79-03842) (Lynch-Wisconsin) W79-03862

## THE VARIABLE CHLOROPHYLL-A FLUORESCENCE AS A MEASURE OF PHOTOSYNTHETIC CAPACITY IN ALGAE,

Oslo Univ. (Norway). Botany Lab.

For primary bibliographic entry see Field 5A.

W79-03863

PLEOMORPHISM OF SCENEDESMUS QUADRICAUDA (TURP.) BREB. (CHLOROPHYCEAE) IN SYNCHRONIZED CULTURES, Hydrobiologisch Inst., Nieuwersluis (Netherlands). C. L. M. Steenbergen.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No 21, June 1978, p 193-206. 2 fig, 4 tab, 27 ref.

Descriptors: \*Morphology, \*Cells, \*Algal, \*Tperiodicity, \*Buoyancy.

Manipulated variables: a pleomorphism, stable symmetries which yield four-celled cultures, 1800.5 mg synchronized eight-cell, 20C in a organic salt morphological system with levels (18C with 14-h diluted, original. Increasing yield a unique day length to partly able to pass stages, as population give rise to long photoperiod survival of unicellular or bottom also W79-03863

## NITROGEN AND UTENSILS

Dundee Univ. (Scotland).

W. D. P. Wilson.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No 21, June 1978, p 193-206. 2 fig, 4 tab, 27 ref.

Descriptors: \*S. Loch (Scotland), *Anabaena*, cyanophyta, Chlorophyta, Structure, Physiology.

Poor conditions and levels of the water partially accumulate a phosphate variety of bodies, phosphate compounds are crucial in may sustain nutrients algal bloom, apparent bodies which how nor flow-aquatic (3) the al-

## Effects Of Pollution—Group 5C

I: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No. 21, June 1978, p216-223. 3 fig, 3 tab, 17 ref.

Descriptors: \**Scedesmus quadricauda*, \*Plant morphology, \*Pleomorphism, \*Coenobia, \*Unicells, Algae, Cultures, Phosphorus, Nutrients, Phytoplankton, Biorhythms, Cytological studies, Buoyancy, Ecology, Survival, Chlorophyta.

Manipulation of environmental conditions produced various degrees of morphological change in a pleomorphic strain of the chlorophytic alga *Scedesmus quadricauda*. Three morphologically stable synchronized culture systems were achieved which yielded either coenobia or unicells: (1) only four-celled coenobia were formed in synchronized cultures grown at 30°C in a medium containing 1800.5 mg/l total inorganic salts; (2) partially synchronized cultures consisting of two-, four-, and eight-celled coenobia developed when grown at 20°C in a medium containing 130.5 mg/l total inorganic salts; and (3) a completely synchronized morphologically stable unicell yielding culture system was achieved at 20°C with high nutrient levels (1800.5 mg/l). Cultures were synchronized with 14-hr light and 10-hr dark cycles, and were diluted daily with fresh nutrient medium to the original cell density of about 400,000 cells/ml. Increasing the nutrient levels in System 2 failed to yield a unicellular system, but in System 3 shortening day length to three hours changed the system to partly coenobial. Spiny *Scedesmus* species are able to produce both unicellular and coenobial stages, as observed in both natural and laboratory populations. Phosphorus enrichment is known to give rise to unicell production, as does a relatively long photoperiod. This pleomorphism may favor survival of the organism as the relative buoyancy of unicells or coenobia enable them to seek surface or bottom nutrient-rich waters, respectively. (See also W79-03842) (Lynch-Wisconsin) W79-03865

NITROGEN AND PHOSPHORUS STORAGE AND UTILIZATION IN BLUE-GREEN ALGAE, Dundee Univ. (Scotland). Dept. of Biological Sciences.

W. D. P. Stewart, M. Pemble, and L. Al-Ugaili.

I: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No. 21, June 1978, p 224-247. 14 fig, 3 tab, 52 ref.

Descriptors: \*Cyanophyta, \*Nitrogen, \*Phosphorus, \*Storage, \*Eutrophication, \*Balgyves Loch (Scotland), Lakes, Scotland, Nutrients, *Anabaena cylindrica*, *Anabaena flos-aquae*, Phytoplankton, Algae, Water pollution effects, Biomass, Chlorophyll, Plant growth, Polyphosphate bodies, Structured granules, Polyhedral bodies, Plant morphology.

Poor correlation between blue-green algal biomass and levels of dissolved nitrogen and phosphorus in the water column of Balgyves Loch, Scotland is partially due to the ability of cyanophytes to accumulate and store cellular reserves of nitrogen, phosphorus, and other material. They may store a variety of compounds intracellularly in nontoxic form and as discrete bodies which they can mobilize readily if required. In particular, their ability to accumulate structured granules and polyphosphate bodies provides a supply of ribulose 1,5-diphosphate carboxylase, the key enzyme for photosynthetic carbon fixation. Accumulation of these compounds and others such as lipid droplets may be crucial in sustaining the algae because: (1) they may sustain growth when exogenous sources of nutrients are limiting, which helps explain how algal blooms develop when nutrient supplies are apparently depleted; (2) accumulation of storage bodies when algal growth is declining may explain how nonporulating algae (such as *Microcystis flos-aquae*) sustain themselves during winter; and (3) the ability to accumulate nutrients in one area

and use them in other areas of the water column is probably an ecological advantage. *Anabaena cylindrica* and *A. flos-aquae* were used in laboratory experiments. (See also W79-03842) (Lynch-Wisconsin) W79-03865

#### COMPOSITION AND PROPERTIES OF LIPID SURFACE FILMS PRODUCED BY CHLOROPHYLLA PYRENODIOSA, Lund Univ. (Sweden). Limnological Inst. A. Södergren.

I: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No. 21, June 1978, p 248-253. 1 fig, 1 tab, 17 ref.

Descriptors: \**Chlorella pyrenoidosa*, \*Lipids, \*Surface films, \*Fatty acids, \*Acids, \*Sampling, Algae, Chlorophyta, Continuous flow, Batch cultures, Air-water interfaces, Lakes, Oceans, Phytoplankton, Chromatography, Research equipment, Methodology, Microlayers, Spectrometers, Organochlorine compounds, Polychlorinated biphenyls, Fungicides, Pollutants, Water pollution effects, On-site tests.

The lipid surface film produced by the chlorophytic alga *Chlorella pyrenoidosa* in continuous-flow and batch cultures was collected with a teflon plate technique (Larsson, et al 1974) and examined by thin-layer and gas chromatography and by mass-spectrometry. To study the composition of the film and to follow organic compounds produced within the cultures,  $\text{NaH}^{14}\text{CO}_3$  was added as a tracer. Myristic acid, palmitic acid, stearic acid, and oleic acid were found in quantities of 2-63 ng/sq cm, with palmitic acid the dominating constituent among free fatty acids, and the pattern of fatty acids in the film was different from that in the algae. Film properties were studied by introducing the lipophilic substances hexachlorobenzene (a fungicide) and hexachlorobiphenyl (a PCB) into the cultures. The major part of these compounds was taken up by the algae, but the surface film also accumulated large amounts. The compounds were transported to the surface film even though the algae were separated from the surface of the culture by a glass fiber filter. Accumulation in the surface film partially explains previously reported losses when lipophilic pollutants were tested in aquatic systems. The accumulation mechanism in the surface film must be considered when water is sampled for organochlorine residue analysis. (See also W79-03842) (Lynch-Wisconsin) W79-03867

#### ACCUMULATION OF LEAD BY SEVERAL GREEN ALGAE, Staatsinstitut für Allgemeine Botanik, Botanischer Garten und Anzuchtgarten Fuhlsbüttel, Hamburg (Germany, F.R.).

A. Weber, M. Melkonian, D. W. Lorch, and M. Wettner.

I: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No. 21, June 1978, p 254-260. 2 fig, 3 tab, 22 ref.

Descriptors: \*Chlorophyta, \*Absorption, \*Bioaccumulation, \*Lead, \*EDTA, \*Food chains, \*Toxicity, \*Heavy metals, Desorption, *Pediastrum tetrads*, *Pediastrum boryanum*, *Pediastrum duplex*, *Fritschiella tuberosa*, *Chlorella pyrenoidosa*, Pollutants, Water pollution effects, Algae, Ions, Metabolism, Light, Oxygen.

Three species of *Pediastrum* (P. tetrads, P. boryanum, and P. duplex) did not accumulate significant amounts of lead when treated with Pb-EDTA, but *Chlorella pyrenoidosa* concentrated the metal at a factor of 2800 and *Fritschiella tuberosa* at a factor of 120. Of the lead accumulated, 85-95% could be described by treatment with 0.001 M sodium-EDTA solution. Lead concentration by *C. pyrenoidosa* from Pb-EDTA was oxygen-de-

pendent and was enhanced by light. The *Pediastrum* species concentrated lead at factors of 1700-7000 when applied in the ionic form  $\text{Pb}^{2+}$ . Chlorophyta thus show considerable variation in lead-concentrating capability; the algae investigated will be incorporated into a model food chain to study possible toxic accumulations at higher trophic levels. Lead concentration from Pb-EDTA may be due to either metabolic processes of the algae or to physico-chemical instability of the complex in the culture media used. The three *Pediastrum* species were cultured axenically in a modified Bold Basal Medium, and the other two species in a mineral medium according to Kessler and Czygan (1970). Aqueous stock solutions of lead (II) nitrate (pH 1) and lead-EDTA at 1 mg Pb/ml were used; lead was added to the culture media either before or after autoclaving at 1 mg Pb/ml. In desorption experiments, lead-treated algae were harvested by a continuous-flow centrifuge, washed, and inoculated into the sodium-EDTA solution. (See also W79-03842) (Lynch-Wisconsin) W79-03867

#### N-UPTAKE AND PIGMENTATION OF N-LIMITED CHEMOSTAT CULTURES AND NATURAL POPULATIONS OF OSCILLATORIA AGARDHII, Amsterdam Univ. (Netherlands). Lab. for Microbiology, Amsterdam (Netherlands).

W. Zevenboom, and L. R. Mur.

I: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No. 21, June 1978, p 261-274. 5 fig, 3 tab, 29 ref.

Descriptors: \**Oscillatoria agardhii*, \*Pigments, \*Nitrogen, \*Limiting factors, \*Eutrophication, \*Absorption, Lakes, Netherlands, Wolderwijd (Netherlands), Veluwemeer (Netherlands). Algae, Cyanophyta, Nutrients, Bioassay, Light, Plant growth, Growth rates, Half-saturation constant, Plant physiology, Kinetics, Nitrates, Succession.

Experiments with the cyanophyte *Oscillatoria agardhii* in chemostat and natural populations taken from two shallow, eutrophic Dutch lakes (Wolderwijd and Veluwemeer) in summer and fall of 1975-76 demonstrate that nitrogen, in addition to light, can become the limiting factor in eutrophic fresh waters. The experiments verified a hyperbolic relationship between nitrogen uptake rate and nitrogen concentration. The chemostat was particularly useful for investigation of relationship between limiting factors and algal succession. Conclusions: (1) the half-saturation constant for nitrate values of the cells varied progressively with the growth rate in the nitrate-limited chemostat cultures, and was therefore not a constant at all; (2) no variation in the ammonia half-saturation constant value was observed for nitrate- and ammonia-limited cells; (3) the maximum uptake rate for nitrate and ammonia was a constant common value; (4) the observed lag time in nitrate uptake by nitrate-starved cells leads to a distinction between nitrate limitation and nitrate starvation (ammonium limitation); (5) pigmentation and nitrogen content of nitrogen-limited chemostate cultures was low compared with data for light-limited cells; (6) pigment and nitrogen content correlated positively with growth rate of the nitrogen-limited chemostate cultures, indicating good regulation of pigmentation and nitrogen content in response to changes in ambient nitrogen levels; and (7) nitrate-limited cells have higher pigment content than ammonia-limited cells. (See also W79-03842) (Lynch-Wisconsin) W79-03868

#### TESTING OF SUBSTANCES FOR THEIR TOXICITY THRESHOLD: MODEL ORGANISMS MICROCYSTIC (DIPLOCYSTIS) AERUGINOSA AND SCENEDESMUS QUADRICAUDA, Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. für Wasser-, Boden-, und Lufthygiene.

G. Bringmann, and R. Kuhn.

I: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

jord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mittelungen No. 21, June 1978, p 275-284. 1 tab, 5 ref.

Descriptors: \*Microcystis aeruginosa, \*Scenedesmus quadricauda, \*Toxicity, \*Pollutants, \*Water pollution effects, \*Bioassay, \*Testing procedures, Algae, Chlorophyta, Cyanophyta, Methodology, Inorganic compounds, Organic acids, Aliphatic esters, Aromatic esters, Alcohols, Bioindicators.

A chlorophyte (*Scenedesmus quadricauda*) and a cyanophyte (*Microcystis aeruginosa*) were selected as model algae to test relative inhibitory effects of 180 pollutants, including 20 inorganic compounds, 11 organic acids, 24 aliphatic and aromatic esters, and 22 alcohol. The minimum inhibitory concentration (toxicity threshold) of 60% of the pollutants was lower for *Microcystis* than for *Scenedesmus*. In seven cases toxicity thresholds for *Scenedesmus* exceeded those for *Microcystis* by two logs, in 45 cases by one log, and in 56 cases by up to one log. In 42 cases (23%) toxicity thresholds were about equal for the two species, and in 30 cases (17%) thresholds were higher for *Microcystis* than for *Scenedesmus*. It is recommended that both organisms be used in pollutant bioassays. The species were chosen as characteristic of cyanophytes and chlorophytes. All substances tested are listed with the toxicity threshold in mg/l for each alga, together with the ratio between the two, with microcystis set at 1.0. In the experiments the cell multiplication inhibition test was used. Since cell multiplication involves the entire metabolism, the result is total coverage of damaging effects of a hazardous water pollutant upon algae, in contrast with inhibition tests based on special physiological processes. The procedure is briefly described. (See also W79-03843). (Lynch-Wisconsin)

W79-03869

### ANATOXINS FROM CLONES OF ANABAENA FLOS-AQUAE ISOLATED FROM LAKES OF WESTERN CANADA

Alberta Univ., Edmonton. Dept. of Botany.

W. W. Carmichael and P. R. Gorham.

In: Symposium: Experimental Use of Algal Culture in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mittelungen No. 21, June 1978, p 285-295. 3 fig, 2 tab, 36 ref.

Descriptors: \*Canada, \*Lakes, \**Anabaena flos-aquae*, \*Toxins, \*Anatoxins, \*Cyanophyta, \*Poisons, \*Livestock, \*Stock water, Alberta(Canada), Saskatchewan(Canada), Algae, Toxicity, Lethal limit, Phytoplankton, *Microcystis aeruginosa*, *Microcystis*, Plant morphology.

Investigation of several cases of algae poisoning of livestock and other animals over the past 15 years in lakes of Alberta and Saskatchewan, in western Canada, has resulted in isolation of four types of anatoxins (designated a-d) from clones of the cyanophyte *Anabaena flos-aquae* taken from blooms from six sources. These six blooms were: (1) Burton Lake, Saskatchewan, June 1961, type a; (2) Echo Lake, Saskatchewan, 1963, type b(S); (3) Buffalo Pound Lake, Saskatchewan, June 1965, type a(S); (4) Disney Lake, Alberta, June 1972, type b; (5) Beaverhill Lake, Alberta, September 1972, type C; and (6) Bendig's Pond, Saskatchewan, August 1975, type d. The qualifier (S) indicates a variation producing severe salivation and lachrymation. Aoxic clones were obtained by repeated cloning using the method of Carmichael and Gorham (1974). Lethal limit and symptoms were determined using lyophilized cultures in mice, rats, and chicks. Photomicrographs of the anatoxins from the six clones are included. The anatoxins' minimum lethal doses for mice, LD sub min (i.p.m.) are 60 for types a-c, and 10 for type d. Mouse survival times were 4-5 min for type a, 8-12 min for type b, 1-2 hrs for type c, and 4-10 min for type d. Of effects identified, three are most indicative of the different toxins: (1) longer survival time-type c; (2) opisthotonus-type a and (3) chromatocystic depolarization compounds; and (3) chromatocystic cryorrhoea (bloody tears)-type d-which is characteristic of anticholinesterase compounds. (See also W79-03842). (Lynch-Wisconsin)

tristic of anticholinesterase compounds. (See also W79-03842). (Lynch-Wisconsin)

### THE BIOGEOGRAPHY OF HOT SPRINGS ALGAE THROUGH ENRICHMENT CULTURES, Oregon Univ., Eugene. Dept. of Biology.

R. W. Castenholz.

In: Symposium: Experimental Use of Algal Culture in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mittelungen No. 21, June 1978, p 296-315. 5 fig, 1 tab, 28 ref.

Descriptors: \*Biogeography, \*Algae, \*Hot springs, \*Cyanophyta, \*Mastigocladus laminosus, \*Cultures, HTF Mastigocladus, *Synechococcus lividus*, *Oscillatoria terebriformis*, *Spirulina labyrinthiformis*, *Chloroflexus aurantiacus*, Prokaryotes, Israel, Water temperature, Yellowstone National Park(WY), Wyoming, Oregon, Montana, Canada, Zaire, Alaska, Arkansas, Mexico, Central America, Japan, New Zealand, Iceland, Azores, Italy, Czechoslovakia, Greece.

Thermophilic blue-green algae were collected from hot springs in western Canada, the United States, Mexico and Central America, Japan, New Zealand, Iceland, the Azores, Italy, Czechoslovakia, Greece, Israel, Zaire, and Uganda to clarify some questions of distribution and dispersal. Thermophilic algae, those able to grow at constant temperatures of 45°C or over, form a group of species with distinct global distribution limits. The only phototrophic organisms which grow in hot springs above about 45-50°C and pH above 5.0 are cyanophytic algae and anoxygenic photosynthetic bacteria; both are prokaryotes. Dispersal is thought to involve simple airborne transport by insects and birds. Hot springs were systematically examined, live collections were studied microscopically, and selective or enrichment cultures were used for many of the species, usually followed by unicellular or clonal isolations to permit detailed comparative studies. Enrichment conditions included high temperature alone, high or low temperature combined with lack of fixed oxygen, media with ammonium nitrogen or a calcium carbonate sediment, and agar medium for motile forms. *Mastigocladus laminosus* was the most widespread species, easily confused with a high temperature form (up to 62-64°C), designated HTF *Mastigocladus*, also widespread. *Synechococcus lividus* had lesser survival abilities, though it was not as restricted as the very sensitive *Oscillatoria terebriformis*. *Spirulina labyrinthiformis* was conspicuously absent from Iceland, the Azores, and New Zealand. (See also W79-03842). (Lynch-Wisconsin)

W79-03873

### EFFECTS OF DIFFERENT PROCESS WASTES AND MAIN SEWER EFFLUENTS FROM PULP MILLS ON THE GROWTH AND PRODUCTION OF ANKISTRODESMEUS FALCATUS VAR. ACICULARIS (CHLOROPHYTA), Jyväskylä Univ. (Finland). Dept. of Biology.

V. Eloranta.

In: Symposium: Experimental Use of Algal Culture in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mittelungen No. 21, June 1978, p 342-351. 4 fig, 2 tab, 26 ref.

Descriptors: \*Pulp wastes, \*Sulfate pulp mills, \*Sulfite pulp mills, \*Water pollution effects, \*Toxicity, \*Bioassay, \*BMT test, *Ankistrodesmus falcatus* var. *acicularis*, Algae, Phytoplankton, Chlorophyta, Sewage disposal, Waste water disposal, Plant growth, Primary productivity, Testing procedures, Industrial wastes, Condensates, Liquors, Acids, Alkalinity, Effluents, Bioindicators.

Modified BMT tests (no autoclaving of effluents) were more sensitive than algal bioassays in assessing effects of untreated cellulose industrial effluents on growth and production of the chlorophyte *Ankistrodesmus falcatus* var. *acicularis*. Process wastes and main sewer effluents from both sulfate and sulfite pulp mills were tested. Of wastewater, spent liquors were the most toxic (with the basic black liquor from the sulfate pulp mill more toxic than the spent acid sulfite liquor), followed by the condensates, the toxicity of which was due to relatively volatile organic sulfur compounds and to resin and fatty acids. The chlorination effluent was more inhibitory in the sulfate than in the sulfite mill, with the reverse true of the alkaline extraction effluent. The sulfite chlorination effluent stimulated algal growth when acidity was not a limiting factor. In bioassays, the acid main sewer effluents were most toxic, followed by basic effluent from the sulfate second main sewer, and acid effluent from the sulfite bleaching. Toxicity of the sulfite main sewer effluent was due mainly to its acidity and volatile compounds. In modified BMT tests basic wastewater from the sulfate second main sewer inhibited algal growth and production most strongly, even at 1% concentration. Chlorophyll-a content determination was too insensitive for studying short-term effects. Carbon-14 was suitable for studying immediate effects, but test conditions must be carefully controlled. (See also W79-03842). (Lynch-Wisconsin)

W79-03874

### THE USE OF SELENASTRUM CAPRICORNUTUM BATCH CULTURES IN TOXICITY STUDIES, Instituto di Ricerca Sulle Acque, Brugherio (Italy).

Instituto di Ricerca Sulle Acque, Brugherio (Italy). For primary bibliographic entry see Field 5A.

W79-03872

### EFFECTS OF RIVER DISCHARGE ON THE COASTAL PHYTOPLANKTON CYCLE, Norwegian Fisheries Directorate, Arendal, Stavanger Biological Station.

E. Dahl.

In: Symposium: Experimental Use of Algal Culture in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mittelungen No. 21, June 1978, p 330-341. 11 fig, 15 ref.

Descriptors: \*Fjords, \*Fjord(Norway), \*Skein River(Norway), \*Discharge(Water), \*Phytoplankton, \*Eutrophication, \*Thermal powerplants, Coasts, Algae, Rivers, Langesund Bay(Norway), Zooplankton, Norway. Primary productivity, Carbon radioisotopes, Baseline studies, Life cycles, Water pollution effects, Heated water, Cool water, Chlorophyll, Salinity, Brackish water.

W79-03874

Studies of the phytoplankton cycle in the Fjord on Norway's southeast coast February 1974-August 1976 showed that cold freshwater discharge from the Skein River produces a pattern distinct from that of the open coast. In the Fjord there is a large summer phytoplankton maximum, but no spring diatom bloom as is found in March at the open coast. A transition zone between the Fjord and the coast tends to both spring bloom and summer maximum. The summer maximum in the Fjord is due to discharge of nutrients, higher temperatures, and longer upholding of the surface layer. The lack of a spring bloom is due to short upholding of the surface layer and low temperature, which contribute to low growth rates. Few or no phytoplankton species can reproduce themselves rapidly in water characterized by sonstal salinity changes. The Skein River has an annual mean water flow of 300 cu m/sec, and initiates a surface current of brackish water running through the branched fjord system towards the coast. Heated cooling water from a proposed thermal power plant would raise temperatures in the brackish productive layer of the Fjord and thereby increase production throughout the year, especially in spring. The heated discharge could probably be constructed to prolong the upholding of the backish layer, and waste heat could be used to improve the outer fjords for recreation. (See also W79-03842). (Lynch-Wisconsin)

W79-03873

WATER ALGAL POLLUTION  
Uppsala Botany. For primary  
W79-03874

THE US POPULATION  
California Studies. For primary  
W79-03874

USE OF LENASTRUM ENOCHIUM DICT EF TERACT GROWTH Corvallis, J. C. Green, Soltero, a. In: Symposium in Lenastrum, Norway. Theoretical studies in Lenastrum, 15 ref.

Descriptors: \*Phytoplankton, Smelters, nutum, Aster, Cult. Standing Polutants. The algal predicting in eutrophication in Europe, and smelter metal effluent, capricornutum. Surface metal growth of algae in EDTA, used to characterize the lake, products of EDTA, crop is not Selenastrum, nautural phyll-a as a limiting nutrient, standing culture, nutrient content, phosphorus or the lake water samples, and limiting nutrient, plankton abundance, but growing crop. (sin) W79-03874

THE APP IN STUDY GREEN A University of Plant Biology. For primary  
W79-03874

THE USE OF MULTISPECIES GATE THE IN A SCO University Dept. of A. K. Jones

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Effects Of Pollution—Group 5C

**WATER CHEMICAL ANALYSES AND/OR ALGAL ASSAY. — SEWAGE EFFLUENT AND POLLUTED LAKE WATER STUDIES,** Uppsala Univ. (Sweden). Inst. for Physiological Botany.

For primary bibliographic entry see Field 5A.  
W79-03875

**THE USE OF NATURAL PHYTOPLANKTON POPULATIONS IN BIOASSAY,** California Univ., Davis. Div. of Environmental Studies.

For primary bibliographic entry see Field 5A.  
W79-03876

**USE OF LABORATORY CULTURES OF SELENASTRUM, ANABAENA AND THE INDIGENOUS ISOLATE SPAHEROCYSTIS TO PREDICT EFFECTS OF NUTRIENT AND ZINC INTERACTIONS UPON PHYTOPLANKTON GROWTH IN LONG LAKE, WASHINGTON,** Corvallis Environmental Research Lab., OR. J. C. Greene, W. E. Miller, T. Shiroyama, R. A. Soltero, and K. Putnam.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No. 21, June 1978, p 372-384. 13 fig, 2 tab, 15 ref.

Descriptors: \*Long Lake(WA), \*Zinc, \*Bioassay, \*Phytoplankton, \*Bottle test, \*Industrial wastes, Smelters, Domestic wastes, Selenastrum capricornutum, Anabaena flos-aquae, Sphaerocystis schroeteri, Cultures, Algae, Cyanophyta, Chlorophyta, Standing crops, Eutrophication, Heavy metals, Pollutants, Runoff, EDTA, Chelation, Nutrients.

The algal assay bottle test was a useful method of predicting indigenous phytoplankton standing crop in eutrophic Long Lake, Washington, an impoundment of the Spokane River polluted by domestic and smelter waste discharges. Conclusions from the 1974-75 studies: (1) Zinc is the dominant heavy metal affecting laboratory cultures of Selenastrum capricornutum grown in Long Lake waters. (2) Surface water runoff directly influences heavy metal concentrations in the lake. (3) Increased growth of Selenastrum and Anabaena flos-aquae in EDTA-spiked lake sample can be directly attributed to chelation of zinc. (4) Sphaerocystis schroeteri, the dominant chlorophyte isolated from the lake, produced its maximum yield without addition of EDTA; the indigenous phytoplankton standing crop is not adversely affected by the zinc. (5) Selenastrum maximum yield correlated well with natural phytoplankton standing crop and chlorophyll-a as well as with the chemically analyzed limiting nutrient. (6) Indigenous phytoplankton standing crop was limited by the primary limiting nutrient content of ambient water (whether phosphorus or nitrogen). (7) Phytoplankton biomass in the lake was limited by nitrogen 57% of the samples, and secondarily by phosphorus (3% of the samples). In the remaining samples the primary limiting nutrient could be determined. (8) Zooplankton grazing may have affected species dominance, but did not significantly affect algal standing crop. (See also W79-03842). (Lynch-Wisconsin)  
W79-03877

**THE APPLICATION OF CULTURE METHODS IN STUDIES OF THE ECOLOGY OF SMALL GREEN ALGAE,** University Coll. of North Wales, Bangor. School of Plant Biology.

For primary bibliographic entry see Field 5A.  
W79-03878

**THE USE OF SMALL, CONTINUOUS AND MULTISPECIES CULTURES TO INVESTIGATE THE ECOLOGY OF PHYTOPLANKTON IN A SCOTTISH SEA-LOCH,** University of Strathclyde, Glasgow (Scotland). Dept. of Applied Microbiology.

K. J. Jones, P. Tett, A. C. Wallis, and B. J. B.

Wood.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No. 21, June 1978, p 398-412. 7 fig, 28 ref.

Descriptors: \*Testing procedures, \*Phytoplankton, \*Loch Creran(Scotland), Ecology, \*Experimental enclosures, \*Methodology, \*Laboratory equipment, Scotland, Algae, Skeletonema costatum, Eucampia zodiacus, Cerataulina pelagica, Cultures, Baseline studies, Lochs, Fjords, Model studies, Nutrients, Zooplankton, Grazing, Limiting factors, Nitrogen, Phosphorus.

Laboratory methods involving simple apparatus (20-liter glass jars) were used to study phytoplankton ecology in filtered water samples from Loch Creran, a sea-loch on Scotland's west coast. Earlier work in the loch itself was complicated by patchiness and water movement. The laboratory cultures were multispecific, continuous, and exposed to a natural illumination cycle. Nine experiments were carried out 1974-75, lasting 1-40 days. With use of a large inoculum, a phytoplankton population that was similar to natural populations in the loch could be grown in the culture vessels 5-30 days. Skeletonema costatum grew well as expected, but Eucampia zodiacus and Cerataulina pelagica, typical of open water, also grew surprisingly well. A 'normal' population was maintained for the longest time with moderate nutrient enrichments coupled with dilution of about 0.2/day. The cultures were used to investigate nutrient status, cell division cycles, and microzooplankton grazing. Use of Drost's nutrient growth model (experiment H) suggested that nitrogen is more likely than phosphorus to control phytoplankton growth in Loch Creran. Culture inocula were taken from a depth of 2-4 m in the loch using 8-liter plastic bottles. A normal population was broadly defined as occurrence of typical sea-loch species, their growth in parallel with the same species in the loch, coherence of growth curves, and the maintenance of moderate diversity. (See also W79-03842) (Lynch-Wisconsin)  
W79-03879

**THE FERTILITY OF SOME NORWEGIAN INLAND WATERS ASSAYED BY ALGAL CULTURES,** Norsk Inst. for Vannforskning, Blindern.

For primary bibliographic entry see Field 5A.  
W79-03880

**SOME ASPECTS ON THE CLASSIFICATION OF NATURAL WATERS BY ALGAL ASSAYS (SGP, PRELUDE),** Helsinki Univ. (Finland). Dept. of Limnology.

For primary bibliographic entry see Field 5A.  
W79-03881

**PHOSPHORUS AVAILABILITY IN THREE STREAMS DURING STORM EVENTS: CHEMICAL ANALYSIS VS. ALGAL ASSAY,** Kent State Univ., Ohio. Dept. of Biological Sciences.

For primary bibliographic entry see Field 5A.  
W79-03882

**MONITORING THE EFFECTS OF CHEMICAL AND BIOLOGICAL WASTE WATER TREATMENT IN SITU BY DIALYSIS CULTURES OF FRESHWATER ALGAE,** Bergen Univ. (Norway). Inst. for General Microbiology.

For primary bibliographic entry see Field 5A.  
W79-03883

**COMPETITION OF THE GREEN ALGA SCENEDESMUS AND THE BLUE-GREEN ALGA OSCILLATORIA,** Amsterdam Univ. (Netherlands). Lab. for Microbiology.

L. R. Mur, J. Gons, and L. Van Liere.

In: Symposium: Experimental Use of Algal Cul-

tures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No. 21, June 1978, p 473-479. 5 fig, 11 ref.

Descriptors: \*Cyanophyta, \*Chlorophyta, \*Oscillatoria agardhii, \*Scenedesmus protuberans, \*Competition, \*Light intensity, \*Growth rates, \*Limiting factors, Turbidity, Phytoplankton, Algae, Succession, Lake, Eutrophication, Plant growth, Phosphates, Turbidity, Shading.

Research about competition between the chlorophyte alga Scenedesmus protuberans and the cyanophyte Oscillatoria agardhii indicate that light is the most important factor regulating blue-green algal blooms. Light distribution in water is greatly influenced by phytoplankton shading; increased concentration of the limiting factor will increase turbidity and favor organisms adapted to low light intensities. Since in freshwater phosphate is the limiting factor, phosphate inputs would therefore stimulate cyanophyte growth. Turbidity is caused by suspended materials and phytoplankton; the latter is more important in most cases. Maximal growth rate ( $\mu$  sub max) of Scenedesmus was found to be 1.58/day, much higher than that of Oscillatoria (0.864/day). The level of limiting incident light intensity for Oscillatoria is 25 W/sq m, and for Scenedesmus about 85 W/sq m. Scenedesmus' maximal growth rate range is 30-85 W/sq m, while for Oscillatoria the range is 6-25 W/sq m. At light intensity lower than two W/sq m Oscillatoria reached a higher growth rate than Scenedesmus. Experimental results are compared to data for the Randmeren Lakes in the Netherlands, where the optimum layer of Scenedesmus was 5-14 cm, and of Oscillatoria was 16-28 cm. In these shallow lakes Scenedesmus growth is impossible at the extinction of 0.05 or higher by a shortage of energy, but Oscillatoria can grow under such conditions. (See also W79-03842) (Lynch-Wisconsin)  
W79-03884

**MODELING OF N- AND P- UPTAKE BY SCENEDESMUS ACUTUS, WITH REGARD TO TERTIARY TREATMENT OF DOMESTIC WASTE WATER,** Ghent Rijksuniversiteit (Belgium). Faculteit Landbouwwetenschappen.

H. R. E. Paclincx, and J. De Maeseneer.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No. 21, June 1978, p 480-489. 4 fig, 15 ref.

Descriptors: \*Scenedesmus acutus var. alternans, \*Tertiary treatment, \*Waste water treatment, \*Nitrogen, \*Phosphorus, \*Nutrient removal, \*Mathematical models, Algae, Phytoplankton, Chlorophyta, Model studies, Absorption, Equations, Domestic wastes, Nutrients, Nitrates, Phosphates.

A model of tertiary wastewater treatment using the chlorophyte alga Scenedesmus acutus var. alternans considers not only the nutrient removed by treatment but also its relationship to other nutrients. The model represents a practical rather than a physiological approach to nutrient removal. Nitrate and phosphate uptake was studied in semicontinuous cultures, renewed after 24 hrs growth. Cultures remained vigorous throughout the experiment. Results showed relationships among initial phosphorus and nitrogen concentrations, dry wt, residual phosphorus and nitrogen, and phosphorus and nitrogen uptake. In this model nutrient uptake is well-established within limits of the experimental design, and extrapolation to other conditions of temperature, illumination, cell concentration, etc. is not possible. Functional equations derived to determine the quantity of dry weight which must be produced to eliminate a certain amount of nutrient (nitrogen or phosphorus) are given graphically. At nitrogen uptake values over 20 mg phosphorus uptake values over 300 laboratory cultures have difficulty maintaining themselves. Additional treatment under such conditions would be necessary for complete nutrient removal. Carbon dioxide could also become limiting under field conditions. (See also W79-03842) (Lynch-Wisconsin)

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

W79-03885

#### RESEARCH ON THE TERTIARY TREATMENT OF SWINE MANURE BY MASS CULTURING OF ALGAE.

Ghent Rijksuniversiteit (Belgium). Lab. for Biological Research in Environmental Pollution. For primary bibliographic entry see Field 5D. W79-03886

#### APPLICATION OF ALGAL ASSAYS IN THE ENVIRONMENTAL EVALUATION OF NEW DETERGENT MATERIALS.

Proctor and Gamble Co., Cincinnati, OH. Environmental Safety Dept. For primary bibliographic entry see Field 5A. W79-03887

#### GROWTH EXPERIMENTS WITH MARINE PLANKTON ALGAE: THE ROLE OF 'WATER QUALITY' IN SPECIES SUCCESSION.

Oslo Univ. (Norway). Dept. of Marine Biology and Limnology.

E. Paasche. In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No. 21, June 1978, p 521-526. 2 fig, 1 tab, 14 ref.

Descriptors: \*Seasonal, \*Succession, \*Marine algae, \*Water quality, \*Oslofjord(Norway), \*Bioassay, \*Eutrophication, Algae, Phytoplankton, Plant growth, Metals, Salts, Limiting factors, Norway, Seasonal, Diatoms, Chrysophyta, *Lauderia annulata*, *Skeletonema costatum*, *Thalassiosira nordenskioldii*, Water chemistry, EDTA, Nitrate, Phosphates, Silicates, Chelation, Fjords.

Experiments with cultures of three representative planktonic marine diatom species grown in seawater samples from the inner Oslofjord, Oslo, Norway and enriched with nitrate, phosphate, and silicate, did not support the hypothesis that phytoplankton succession is influenced by variations in water quality. The study suggests that the only variations in chemical properties of the water likely to influence succession are seasonal changes in inorganic nutrient salts, such as nitrate or silicate. There was no indication that substances inhibitory to diatom growth were produced by any algae in the highly eutrophic inner Oslofjord, despite the presence of several algal species which grew to high densities. Growth of the three species in the test cultures—the widespread *Skeletonema costatum*, the cold-water species *Thalassiosira nordenskioldii*, and the warm-water species *Lauderia annulata*—was not restricted to any particular season. For example, *Skeletonema* grew no faster in May-June, the normal period of abundance, than at other times. Addition of EDTA to the water did not improve diatom growth. Metals present in soluble form appeared to be adequately balanced by naturally occurring chelators; according to several authors water quality is largely determined by the degree of complexation of trace metals. (See also W79-03842) (Lynch-Wisconsin) W79-03888

#### ALGAL TESTS USED TO STUDY THE CHEMICAL FACTORS REGULATING THE GROWTH OF PLANKTONIC ALGAE IN THE HELSINKI SEA AREA,

Helsinki City Engineer's Office (Finland). Water Conservation Lab. For primary bibliographic entry see Field 5A. W79-03889

#### RELATIONSHIP BETWEEN ALGAL PHOSPHORUS EXTRACTION AND WATER PHOSPHORUS CONCENTRATION,

FMC Corp., Princeton, NJ. Research and Development Center.

J. Saldick, and S. E. Coleridge. In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No. 21, June 1978, p 547-554. 6 tab, 11 ref.

jord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No. 21, June 1978, p 547-554. 6 tab, 11 ref.

Descriptors: \*Soluble reactive phosphorus, \*Phosphorus, \*Algae, \*Bioassay, \*Absorption, \*Ceratophyllum, Macrophytes, Nutrients, Phosphates, Streams, Lakes, Indiana, Connecticut, Illinois, New York, Oedogonium, Hydrodictyon, Cladophora, *Seleniastrum capricornutum*, Chlorophyta, Aquatic plants, Plant growth, Bottle test, Water chemistry, Phytoplankton.

Algae and macrophytes were sampled in streams and lakes in New York, Connecticut, Indiana, and Illinois 1973-75 during an environmental studies program of FMC Corporation for analysis of soluble reactive phosphorus (SRP) content of plants and water. Cladophora, Oedogonium, Hydrodictyon, and Ceratophyllum gave good linear correlations between SRP extracted from the plants and SRP in the ambient water. The macrophyte Ceratophyllum yielded relatively more extracted SRP than did the algae. SRP concentrations in the water 1-2 weeks prior to harvesting affected the quantity of SRP extracted. SRP in the indigenous Cladophora varied with geographic location. Subsequent experiments included: (1) algal assays with the EPA bottle test using the chlorophyte *Seleniastrum capricornutum*; (2) harvesting of Cladophora (*Chlorophyta*) June 1975 from streams in Erie County, New York, and relocating to phosphorus-rich or phosphorus-poor streams where they were suspended in nylon mesh bags 15 cm below the surface for 1-2 days to assess SRP uptake; and (3) harvesting of Cladophora from a low-phosphate stream in New York (less than five micrograms SRP/l) and transplanting to lakes in Indiana and central New York. Transplantation of phosphorus-poor Cladophora into phosphorus-rich streams for 24-48 hrs gave 0.1-2.0% extractable SRP. (See also W79-03842) (Lynch-Wisconsin) W79-03890

#### THE ALGAL GROWTH POTENTIAL OF AN INLAND SALINE AND EUTROPHIC LAKE,

North Dakota Univ., Grand Forks. Dept. of Biology.

L. E. Shubert. In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No. 21, June 1978, p 555-574. 22 fig, 6 tab, 64 ref.

Descriptors: \*Eutrophication, \*Devil's Lake(ND), \*Algal growth potential, \*Limiting factors, \*Nutrients, \*Saline lakes, \*Sewage disposal, North Dakota, Lakes, Nitrogen, Phosphorus, Bioassay, Chlorella, Chlorophyta, Cyanophyta, EDTA, Trace elements, Glucose, Organic matter, Alkalinity, Shallow lakes, Water level fluctuations, Water pollution effects, Salinity, Algae, Bioindicators, Culture media.

Algal growth potential and limiting nutrients were bioassayed in Devil's Lake, a saline, alkaline (pH 8-9), eutrophic, shallow (mean depth five meters) lake in northeastern North Dakota. Evaporation exceeds precipitation, causing water level fluctuations and changes in salinity. Surface water samples were collected bimonthly from nine stations in the 23,200-ha lake during 1974-75. Water chemistry was determined, and the chlorophyte *Chlorella* DL 7-24-01 was used in the bioassays with Devil's Lake medium, a synthetic nutrient medium formulated on the basis of lake water sample analysis. Algal growth was measured daily, and for limiting tests, cultures were spiked with one of eight nutrient combinations involving nitrogen as sodium nitrate, phosphorus as K<sub>2</sub>HPO<sub>4</sub>, a trace element mixture, EDTA, and glucose. Algal growth was highest July-August with maximum temperatures and solar radiation; cyanophyta were dominant, especially *Microcystis aeruginosa* and *Aphanizomenon flos-aquae*. Overall growth averaged 1.91 cell doublings every 48 hrs August 1974 to August 1975. In spiked cultures, growth stimulation overall was statistically significant with EDTA alone, nitrogen/phosphorus, and all nutrients together except

glucose. During July and August no additions stimulated growth. High nutrient levels in the lake are partially due to sewage inputs. (See also W79-03842) (Lynch-Wisconsin) W79-03891

#### SORPTION AND CONCENTRATION OF TOXIC MINERALS BY MASS CULTURES OF CHLOROCOCCALES.

Gesellschaft für Strahlen- und Umweltforschung m.b.H., Dortmund (Germany, F.R.). C. J. Soeder, H. D. Payer, K. H. Runkel, J. Beine, and E. Biele.

In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No. 21, June 1978, p 575-584. 2 fig, 6 tab, 15 ref.

Descriptors: \*Sorption, \*Lead, \*Cadmium, \*Pollutants, \*Coelastrum proboscideum, \*Scenedesmus acutus var. alternans, Chlorophyta, Poisons, Toxicity, Hydrogen ion concentration, Thailand, West Germany, Mass cultures, Cultures, Bioassay, Algae, Phytoplankton, Water pollution sources, Air pollution, Potable water, Fertilizers.

Lead and cadmium sorption by the green alga *Coelastrum proboscideum* was studied in laboratory and greenhouse cultures, and accumulation of several toxic minerals in the biomass of the chlorophyte *Scenedesmus acutus* var. *alternans* was compared under outdoor conditions in Bangkok, Thailand, and Dortmund, West Germany. Upon exposure to a medium containing 0.5-1.0 ppm lead at 30°C, *Coelastrum* biomass contained 1400-2200 ppm lead (dry wt) after a few hours. The sorption rate was reduced by lower temperature and higher concentrations of calcium and magnesium in the medium, but not influenced by inhibitors of photosynthesis or phosphorylation. Cadmium sorption potential was lower; growth in a medium containing 40 ppb cadmium resulted in a maximal concentration in the alga of 25 ppm. Cadmium sorption increased with pH. In the outdoor experiments (1972-73), *Scenedesmus* was grown in mass cultures yielding 10-20 g dry matter/sq m/day. Harvested material was dried, analyzed for lead, cadmium, mercury, antimony, selenium, tin, arsenic, and bromine, and the relative contribution of air pollution, tapwater, and fertilizer was statistically determined. This method is suitable for evaluating a site's overall pollution load. The Dortmund data indicated arsenic and cadmium came mainly from fertilizer; tapwater was the major source of bromine, mercury, and tin, and air pollution of lead and antimony. (See also W79-03842) (Lynch-Wisconsin) W79-03892

#### THE ROLE OF NUTRIENT COMPETITION IN A PREDICTIVE THEORY OF PHYTOPLANKTON POPULATION DYNAMICS,

Minnesota Univ., St. Paul. Dept. of Ecology and Behavioral Biology.

D. Tilman. In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No. 21, June 1978, p 585-592. 1 fig, 25 ref.

Descriptors: \*Phytoplankton, \*Population dynamics, \*Silicates, \*Limiting factors, \*Monod equation, \*Competition, \*Model studies, Algae, *Cyclotella meneghiniana*, *Asterionella formosa*, Forecasting, Mathematical models, Lakes, Great Lakes, Lake Michigan, Diatoms, Chrysophyta, Half-saturation constant, Plant growth, Growth rates, Nutrients, Plant physiology, Equations.

Previous work utilizing the Monod physiological model of species competition for a nutrient is extended to help develop a more general theory of phytoplankton population growth. Experiments measuring competition for phosphate and silicate by the diatoms *Asterionella formosa* and *Cyclotella meneghiniana* showed little difference in maximal growth rate, but results showed that A

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## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Effects Of Pollution—Group 5C

formosa was significantly better than *C. meneghiniana* at growing under phosphate limitation while the reverse was true under silicate limitation. That is, *A. formosa* had a significantly lower half saturation constant for phosphate-limited growth, and *C. meneghiniana* for silicate-limited growth. The Monod model was remarkably accurate in predicting the outcome of the two species grown together at various supply ratios of silicate and phosphate. *Asterionella* was dominant where both species were phosphate limited, *Cyclotella* was dominant where both species were silicate-limited, and coexistence was stable where each was limited by a different nutrient. Relative abundance of the two species in Lake Michigan along a natural gradient of silicate and phosphate was then predicted, assuming steady-state concentrations of extracellular nutrients. Four additional factors may affect species distribution: (1) nutrient physiology of major species, (2) nutrient supply rates, (3) species-specific mortality rates, and (4) physical factors such as temperature, light, pH, and major ions. (See also W79-03842) (Lynch-Wisconsin) W79-03893

#### CHANGES IN SUCCESSION RATE IN A NATURAL PHYTOPLANKTON COMMUNITY FOLLOWING NUTRIENT ENRICHMENT, Stockholm Univ. (Sweden). Inst. of Botany.

L. Tinnberg.  
In: Symposium: Experimental Use of Algal Cultures in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No 21, June 1978, p 593-599. 4 fig, 9 ref.

Descriptors: \*Nutrients, \*Eutrophication, \*Brunnsviken(Sweden), \*Phytoplankton, \*Succession, \*Limiting factors, \*Succession rates, Algae, Sweden, Baltic Sea, Bays, Water pollution effects, Sewage disposal, Diversion, Brackish water, Forecasting, Nitrates, Phosphates, Species composition, Batch cultures, *Oscillatoria agardhii*, Cyanophyta.

Calculation of the phytoplankton succession rate 1973-75 in Brunnsviken, a small, isolated, brackish bay of the Baltic Sea in Stockholm, Sweden, showed one minimum during the spring bloom in April, and another beginning in June-July caused by a bloom of the cyanophyte *Oscillatoria agardhii*. Succession rates calculated from laboratory cultures can be used to predict effects of changes in nutrient levels on natural phytoplankton populations during summer stagnation. Depletion of nitrate and phosphate occurred during the cyanophyte bloom, and addition of these nutrients increased succession rates from July-October. From November-February the succession rate was high both under natural conditions and in batch cultures, making it difficult to evaluate the effect of enrichments by calculating succession rates. Sewage effluents were diverted from the bay in 1969, and during the summer stagnation of 1974 phosphate and nitrogen depletion reached limiting levels for some phytoplankton for the first time since diversion. Succession rate was used in this study as a measure of the rate of change in phytoplankton species composition. Samples were collected from a depth of 0.5 m with a 1.5-liter Ruttner sampler approximately biweekly, phytoplankton were counted, and total volumes were calculated for each species. To determine the limiting nutrient, batch culture tests were carried out on natural phytoplankton sampled biweekly. (See also W79-03842) (Lynch-Wisconsin) W79-03894

#### COHO SALMON (ONCORHYNCHUS KISUTCH) AND HERRING GULLS (LARUS ARGENTATUS) AS INDICATORS OF ORGAN-CHLORINE CONTAMINATION IN LAKE ONTARIO, Canadian Wildlife Service, Ottawa (Ontario). Wildlife Toxicology Div.

For primary bibliographic entry see Field 5A. W79-03895

#### CORRELATIONS BETWEEN SPECIFIC ALGAE AND HEAVY METAL BINDING IN LAKES, Ottawa Univ. (Ontario). Dept. of Biology.

F. Briand, R. Trucco, and S. Ramamoorthy. Journal of the Fisheries Research Board of Canada, Vol 35, p 1482-1485. 1978. 1 fig, 2 tab, 16 ref.

Descriptors: \*Heavy metals, \*Diatoms, \*Chlorophyta, \*Mercury, \*Copper, \*Lead, \*Cadmium, Biomass, Phytoplankton, Nutrients, Physicochemical properties, Water chemistry, Chemical analysis, Phosphates, Aquatic algae, \*Bioaccumulation.

Long-term experiments conducted at Heney Lake, Quebec, show the binding capacity for the metal ions Cu<sup>2+</sup>, Hg<sup>2+</sup>, Pb<sup>2+</sup>, and Cd<sup>2+</sup> to be related to algal species composition rather than to total algal biomass or physicochemical parameters. Most of the binding could be accounted for by certain species of green algae, diatoms, and chrysophytes that usually constituted only a minor fraction of the total algal volume. (EIS-Deal) W79-03896

#### CULTURE STUDIES ON THE EFFECTS FROM FLUORIDE POLLUTION ON THE GROWTH OF MARINE PHYTOPLANKTONS, British Columbia Univ., Vancouver (British Columbia). Dept. of Botany.

L. Oliveira, N. J. Antia, and T. Bisalputra. Journal of the Fisheries Research Board of Canada, Vol 35, p 1500-1504, 1978. 1 fig, 1 tab, 21 ref.

Descriptors: \*Growth rates, \*Fluorides, \*Toxicity, Diatoms, Dinoflagellates, Phytoplankton, Inhibition, Metabolism, Water chemistry, Water analysis, Chemical analysis, Industrial wastes, Nutrients, Salinity, Sea water, Marine phytoplankton.

The autotrophic growth of 12 species of marine phytoplankton, from eight classes of algae, was tested on axenic cultures with NaF additions of 0-100 mg F/L. All species showed good growth without indication of toxicity or adaptation lag. The highest fluoride concentration caused 25-30% growth-rate inhibition of a diatom, a dinoflagellate, and a haptophyte; other diatoms and species from other classes of algae were virtually unaffected. It is hypothesized that the unexpected lack of toxicity from F- ion may be due to the formation of innocuous complexes with one or more ions of seawater. The ecological inference is drawn that fluoride pollution may be readily tolerated by some marine phytoplankton under nutrient-sufficient conditions. (EIS-Deal) W79-03897

#### A STEADY-STATE PHYTOPLANKTON MODEL OF CHESAPEAKE BAY, Hydroscience, Inc., Westwood, NJ.

H. J. Salas, and R. V. Thomann. Journal Water Pollution Control Federation, Vol. 50, p 2752-2770, 1978. 15 fig, 2 tab, 8 ref.

Descriptors: \*Model studies, \*Mathematical models, \*Phytoplankton, \*Chesapeake Bay, Eutrophication, Chlorophyll, Biomass, Nutrients, Nitrogen, Phosphorus, Growth rates, Productivity, Municipal wastes, Water quality, Water chemistry, \*Susquehanna River.

A quasi-linearized, steady-state model of nutrient-phytoplankton interactions is constructed for the Chesapeake Bay system to provide a first basis for allocation of nutrient discharges. The results of the data and model evaluations indicate that phosphorus is more important than nitrogen in limiting phytoplankton growth in the Chesapeake Bay proper above the Potomac River. The most significant sources of nutrients to the bay are from the Baltimore metropolitan area and the Susquehanna River. First estimates of the reaction coefficients were obtained from approximation to the nonlinear theory and then further refined using the two years of data. Estimates of the impact on phytoplankton biomass, as measured by chlorophyll a, as a result of reduced phosphorus discharges are determined

from the model for different regions of the bay. (EIS-Deal) W79-03899

#### LYSOSOMAL RESPONSES TO EXPERIMENTALLY INJECTED ANTHRACENE IN THE DIGESTIVE CELLS OF MYTILUS EDULIS, Institute for Marine Environmental Research, Plymouth (England).

M. N. Moore, D. M. Lowe, and P. E. M. Fieth. Marine Biology, Vol. 48, p. 297-302, 1978. 1 fig, 2 tab, 17 ref.

Descriptors: \*Cytological studies, \*Toxicity, \*Mussels, Animal physiology, Animal metabolism, Aromatic compounds, Chemical analysis, Biochemistry, Enzymes, Digestion, Commercial shellfish, \*Anthracene, \*Tissue analysis, Mytilus, \*Lysosomes.

Experimentally injected anthracene has been shown to induce dose-dependent lysosomal destabilisation and release of hexosaminidase in the digestive cells of *Mytilus edulis* after 24 h. This destabilisation was accompanied by cytological evidence of cytolysis of the digestive cells. The destabilising effect of 100 microgram of injected anthracene persisted for 96 h with a return to the control condition by 168 h. These results are discussed in the content of environmental contamination by polycyclic aromatic hydrocarbons. (EIS-Deal) W79-03900

#### 237PU EXPERIMENTS WITH THE PLAICE PLEURONECTES PLATESSA, Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Radiobiological Lab.

R. J. Pentreath. Marine Biology, Vol. 48, p. 327-335, 1978. 6 fig, 6 tab, 13 ref.

Descriptors: \*Radioisotopes, \*Isotope studies, Fish physiology, Radioactivity, Radioecology, Radioactive wastes, Tracers, Animal metabolism, Digestion, Absorption, Crabs, Path of pollutants, Growth stages, Chemical analysis, Radiochemical analysis, \*Plutonium, \*Paice, Pleuronectes, \*Tissue analysis, \*Bioaccumulation.

Several experiments have been performed on the metabolism of <sup>237</sup>Pu - a high specific activity, gamma-emitting isotope of plutonium - by the plaice *Pleuronectes platessa*. Very little of the isotope was incorporated into fish after 2 months exposure to labelled water. The oral retention from a variety of labelled foods was also very poor, and apart from the gut itself no incorporation of the isotope could, in fact, be demonstrated. Injected <sup>237</sup>Pu was eliminated very slowly, and some evidence was obtained for an inverse relationship between the rate of <sup>237</sup>Pu loss and the rate of growth of the fish. Growing fish incorporated a relatively larger fraction of the <sup>237</sup>Pu body burden into skeletal material, and this was attained at the expense of the isotopic content of the liver. Very little <sup>237</sup>Pu was incorporated into muscle. (EIS-Deal) W79-03901

#### THE IMPORTANCE OF THE TIME FACTOR IN THE RESPONSE OF ZOOPLANKTON TO VARYING CONCENTRATIONS OF NATURALLY OCCURRING PARTICULATE MATTER, Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.

P. Mayaud, and S. A. Poulet. Limnology and Oceanography, Vol. 23, No. 6, p. 1144-1154, 1978. 7 fig, 1 tab, 37 ref.

Descriptors: \*Food habits, Model studies, \*Copepods, \*Food abundance, Mathematical models, Zooplankton, Animal behavior, Feeding rates, Animal populations, Food chains, Biomass, Enzymes, Biochemistry, Chemical analysis, Proteins, \*Pseudocalanus, \*Tissue analysis, Particulate matter.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

Over the course of a year a linear relationship was found between feeding rates of five species of neritic copepods and their probable food supply, the naturally occurring particulate matter. However, a saturation-type curve was obtained when a range of food concentration was offered to *Pseudocalanus minutus* over a short period of time (18-20h). Digestive enzyme levels of the copepod population were also found to vary linearly on a seasonal basis. The affinity appeared to vary with time, indicating acclimation in the digestive system. A new model, linear for variations of food concentrations over an extended period of time (weeks to a year) and curvilinear for variations over a time smaller than the one needed for acclimation, is developed. (EIS-Deal) W79-03902

**POLYCHLORINATED BIPHENYL (PCB) UPTAKE BY MARINE PHYTOPLANKTON,**  
Stanford Univ., Pacific Grove, CA. Hopkins Marine Station.  
L. W. Harding, Jr. and J. H. Phillips, Jr.  
Marine Biology, Vol. 49, p. 103-111, 1978. 7 fig, 1 tab, 41 ref.

Descriptors: \*Polychlorinated biphenyls. \*Phytoplankton. \*Adsorption. Absorption. Toxicity. Photosynthesis. Growth rates. Inhibition. Aquatic populations. Biomass. Path of pollutants. Chemical wastes. Marine algae. \*Freundlich adsorption isotherm.

The time-courses of uptake for 2,4,5,2',5'-pentachlorobiphenyl (PCB) by 11 marine phytoplankton species were measured and found to be rapid, with equilibration occurring within 0.5 to 2.0 h. These data were described with the empirical Freundlich adsorption isotherm. The relationship between cell density and accumulation of PCBs was also investigated. Concentration factors on a volume per volume basis ranged from  $1.23 \times 10$  to the 4th power to  $2.41 \times 10$  to the 6th power for the 11 algal species examined. These values are comparable in magnitude to factors reported previously for phytoplankton in natural marine systems. (EIS-Deal) W79-03903

**POLYCHLORINATED BIPHENYLS: ACCUMULATION FROM CONTAMINATED SEDIMENTS AND WATER BY THE POLYCHAETE NEREIS DIVERSICOLOR,**  
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.  
S. W. Fowler.  
Marine Biology, Vol. 48, p 303-309, 1978. 4 fig, 20 ref.

Descriptors: \*Polychlorinated biphenyls. \*Absorption. Sediments. Worms. Water chemistry. Animal metabolism. Animal physiology. Chemical analysis. Gas chromatography. Path of pollutants. Chemical wastes. Benthic fauna. \*Tissue analysis. \*Bioaccumulation. \*Polychaetes. \*Nereis. Depuration.

Comparisons were made of the accumulation of a PCB mixture from sediments and from water by the benthic worm *Nereis diversicolor*. Uptake from sediments was dose-dependent, attaining equilibrium concentration factors of approximately 3 to 4 after 2 months. Subsequent PCB elimination rates were concentration-dependent, with higher initial loss rates evident in the worms containing higher levels of PCBs. Accumulation of PCBs from water was much more rapid; concentration factors reached approximately 800 after only 2 weeks. Estimates were made of the relative importance of sediments and water as a source of PCBs to worms exposed to these contaminants in the natural environment. Calculations based on experimentally derived PCB concentration factors and ambient PCB levels in sediments and water suggest that compared to water, sediments contribute the bulk of these compounds to the worms. The possible mechanisms involved in the uptake of sediment-associated PCBs are discussed. (EIS-Deal) W79-03904

### EFFECTS OF SEDIMENTS ON THE DEVELOPMENT OF MACROCYSTIS PYRIFERA GAMETOPHYES.

University of Southern California, Los Angeles. Environmental Engineering Program.  
J. S. Deviny, and L. A. Volz.  
Marine Biology, Vol. 48, p. 343-348, 1978. 2 fig, 17 ref.

Descriptors: \*Sediments. \*Growth stages. \*Kelps. \*Spores. Reproduction. Plant growth. Plant physiology. Benthic flora. Turbidity. Dredging. Sewage effluents. Sediment discharge. Mortality. Sedimentation rates. \*Macrocystis.

Rocky ocean bottoms are covered from time to time with small amounts of fine sediments. This material may interfere with the development of germling stage of *Macrocystis pyrifera*. Tests were performed by introducing sediments before and after spores were dispersed in culture dishes. 10 mg cm<sup>-2</sup> of sediment, enough to occlude the surface, prevents spore attachment, greatly reducing the probability of survival. Smothering of established germlings was severe at 108 mg sediment cm<sup>-2</sup>. Water motion further reduced spore success where sediments were present, probably because of abrasive scour. Mechanisms of natural and human interference with *M. pyrifera* reproduction are suggested. (EIS-Deal) W79-03905

### PROCEEDINGS OF THE FIRST AND SECOND USA-USSR SYMPOSIA ON THE EFFECTS OF POLLUTANTS UPON AQUATIC ECOSYSTEMS-VOLUME I: DULUTH, MINNESOTA, USA SYMPOSIUM OCTOBER 21-23, 1975, VOLUME II: BOROK, JAROSLAV OBLAST, USSR SYMPOSIUM JUNE 22-26, 1976.

Environmental Protection Agency, Grosse Ile, MI. Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 219. Price codes: A18 in paper copy, A01 in microfiche. Report EPA-600/3-78-076, 412 p, 1978. Mount, D. I., W. R. Swain and N. K. Ivanikiv, eds. W79-03912

Descriptors: \*Conferences. \*Ecosystems. \*Aquatic environment. International symposiums. \*USSR. Ecology. Aquatic populations. Fish populations. Toxicity. Water quality. Water quality control. Water quality standards. Bioassay. Fish physiology. Fish diseases. Fish parasites. Eutrophication. Trophic level. Productivity. Chemical wastes. Industrial wastes. Municipal wastes. Pesticide residues. Pesticide toxicity. \*Symposium.

The published papers from these symposia contain both broadly based review papers, designed to familiarize attendees with a wide cross-sectional representation of ecologically related activities in each country, and narrowly specific state-of-the-art scientific discussions. The presentations focus upon methodology, historical aspects, microbial and abiotic degradation processes, trace metal problems, effects of toxicants, proposed species indices, and studies of fate and transport of pollutants. (See W79-03907 thru W79-03940) (EIS-Deal) W79-03906

### PERMISSIBLE POLLUTION LEVELS OF WATER BODIES.

Moscow State Univ. (USSR). Dept. of Biology. For primary bibliographic entry see Field 5G. W79-03907

### A BRIEF HISTORY OF WATER POLLUTION RESEARCH IN UNITED STATES.

For primary bibliographic entry see Field 5G. W79-03908

### CHARACTERISTICS OF THE MOSCOW RIVER WATER QUALITY ACCORDING TO HYDROBIOLOGICAL INDICES.

For primary bibliographic entry see Field 5A. W79-03909

### ENDPOINTS IN BIOASSAY.

For primary bibliographic entry see Field 5A. W79-03910

### PHYSIOLOGICAL-BIOCHEMICAL ASPECTS OF WATER TOXICOLOGY.

Tsentralnyi Nauchno-Issledovatel'skii Inst. Osetrovoogo Khozyaistva, Astrakhan (USSR). For primary bibliographic entry see Field 5A. W79-03911

### BIOENERGETIC AND OTHER CONSIDERATIONS IMPORTANT IN THE STUDY OF WATER QUALITY INFLUENCES ON FISH GROWTH.

P. Doudoroff.

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. 1, Environmental Protection Agency, Report EPA-600/3-78-076, p. 55-67, 1978. 12 ref.

Descriptors: \*Growth rates. \*Toxicity. \*Energy budget. Fish physiology. Animal metabolism. Poisons. Energy. Energy conversion. Nutrients. Cycling nutrients. Growth stages. Water pollution effects. Fish behavior. Food habits. Water temperature.

To understand effects of environmental factors on the growth of animals it is essential to consider to what extent and to what ends the energy and materials of food consumed by the animals are utilized and how they are distributed, under what conditions, among portions having different fates. A general procedure and several studies are proposed, based on important bioenergetic and ecological considerations, for efficient experimental investigation of undesirable effects on fish growth of water pollutants, especially toxic ones. (See also W79-03906) (EIS-Deal) W79-03912

### MONITORING THE CONDITION OF FLOWING WATERS BY BIOLOGICAL ORGANISMS.

For primary bibliographic entry see Field 5A. W79-03913

### THE ROLE OF ALGAE IN THE POLLUTION OF RESERVOIRS AND PROBLEMS OF CONTROLLING THEIR NUMBERS.

Moscow State Univ. (USSR). V. G. Khobot'ev.

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. 1, Environmental Protection Agency, Report EPA-600/3-78-076, p. 82-86, 1978. 4 ref.

Descriptors: \*Eutrophication. \*Phytoplankton. \*Algalicides. \*Algal control. Reservoir operation. Reservoirs. Water supply. Nutrients. Chemical analysis. Water quality. Water treatment. Cyanophyta. Filtration. Chlorination. Mollusks. Daphnia. Photosynthesis. Monuron. Biocontrol. \*Diuron.

In some polluted waters, with nutrient enrichment and slightly increased temperature, favorable conditions are created for massive development of algae. The enhanced growth of phytoplankton creates a considerable nuisance in water supplies, since it often disturbs treatment processes and impairs the quality of water produced. Biological, mechanical, physical and chemical methods of controlling algal blooms are compared. No one method is best and there should be several such methods for specific purposes for each water body. (See also W79-03906) (EIS-Deal) W79-03914

### EUTROPHICATION IN THE UNITED STATES: PAST-PRESENT-FUTURE.

For primary bibliographic entry see Field 5G. W79-03915

DETERMINATION OF POLYCHLORINATED BIPHENYL CONCENTRATION IN MARINE ORGANISMS.

L. A. Sire.

Birger.

In: Proc.

USSR Symp.

Aquatic Ecosystems.

114, 1978.

Descriptive ecology. Ecological thesis. Animal Metabolism. Minerals. Animals. Zooplankton.

It is important to consider the change, the natural mechanism with other particular dependence on temperature and concentration of dioxide, manganese, biological status, etc. Thus, it is proved to be 03906 (EIS-Deal) W79-03912

TOXICITY OF POLYCHLORINATED BIPHENYLS.

Michigan.

For primary

W79-03912

BALANCE OF ECOSYSTEMS.

VOIR,

Academie.

Vnukovskii.

V. I. Romanov.

In: Proc.

USSR Symp.

Aquatic Ecosystems.

131, 1978.

Descriptive elements. Production level. \*Ecology. Chemical. Plant growth.

Detailed information on the reservoir element, its input and output. (See also W79-03912)

THE IMPACT OF THE BASIC POLLUTANTS ON THE ENVIRONMENT.

Academie.

Vnukovskii.

P. P. Umnov.

In: Proc.

USSR Symp.

Aquatic Ecosystems.

151, 1978.

Descriptive matter. \*Ecology. Growth rate. Biomass. Cloning capacity.

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Bacteria a-

## Effects Of Pollution—Group 5C

**DETERMINING THRESHOLD AND BIOLOGICALLY DANGEROUS CONCENTRATIONS OF BLUE-GREEN ALGAE IN WATER BODIES, Akademiya Nauk UkrSSR, Kiev. Inst. Hidrobiologii.**

L. A. Sirenko, A. Ya. Malyarevskaya, and T. I. Birger.

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. 1, Environmental Protection Agency, Report EPA-600/3-78-076, p 105-114, 1978. 4 tab, 8 ref.

**Descriptors:** \*Cyanophyta, \*Toxicity, \*Fish physiology, Eutrophication, Growth rates, Photosynthesis, Algal toxins, Water chemistry, Nutrients, Metabolism, Animal metabolism, Mortality, Vitamins, Animal pathology, Amino acids, Biochemistry, Zooplankton, Algae, \*Tissue analysis.

It is important to remember that biologically dangerous concentrations of blue-green algae may change, depending on the effect of the algae's natural metabolites and synergism or antagonism with other biotic or abiotic water substances. In particular, the toxicity of blue-green algae will depend both on a series of chemical indices (temperature effect, content of oxygen in water, carbon dioxide, the presence of salts of such metals as manganese, zinc and lithium) and on the physiological state of algae cells (living, dead, decomposing). Thus, in our experiments, decomposing algae proved to be more toxic for fish. (See also W79-03906) (EIS-Deal)

W79-03916

**TOXIC ORGANIC RESIDUES IN FISH, Michigan State Univ., East Lansing.**

For primary bibliographic entry see Field 5A. W79-03917

**BALANCE OF ORGANIC MATTER IN THE ECOSYSTEM OF THE RYBINSKIY RESERVOIR, Akademiya Nauk SSSR, Moscow. Inst. Biologii Vnutrennykh Vod.**

V. I. Romanenko.

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. 1, Environmental Protection Agency, Report EPA-600/3-78-076, p 121-131, 1978. 3 fig, 3 tab, 10 ref.

**Descriptors:** \*Reservoirs, \*Organic matter, \*Nutrients, Productivity, Primary productivity, Trophic level, \*Ecosystems, Phytoplankton, Photosynthesis, Chemical oxygen demand, Bacteria, Biomass, Plant growth, \*Rybinsk Reservoir (USSR).

Detailed data is presented on the main elements which contribute to withdraw organic matter from the reservoir. The relative contribution of each element is assessed and the difference between input and expenditure of organic matter is computed. (See also W79-03906) (EIS-Deal)

W79-03918

**THE IMPORTANCE OF TROPHIC BONDS IN THE BACTERIAL DESTRUCTION OF ORGANIC MATTER, Akademiya Nauk SSSR, Moscow. Inst. Biologii Vnutrennykh Vod.**

P. P. Umorin.

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. 1, Environmental Protection Agency, Report EPA-600/3-78-076, p. 132-151, 1978. 11 fig, 2 tab, 18 ref.

**Descriptors:** \*Protozoa, \*Bacteria, \*Organic matter, Water purification, Mathematical models, Growth rates, Model studies, Nutrients, Nitrogen, Biomass, Phenols, Trophic level, Predations, Cycling nutrients, Food chain, Waste assimilative capacity.

The interrelations of bacteria and protozoa in the rate of decomposition of organic matter is studied. Bacteria are the main consumer of organic matter

in water bodies. Zooflagellates cannot affect the rate of decomposition of dissolved organic matter. As for infusoria, they can notably slow down the decomposition of organic matter by bacteria by means of reducing their number due to predation. However, in water bodies, as a rule, a deficiency in nutrients has been observed. Guaranteeing their recycling, infusoria may accelerate the bacterial destruction of organic matter. (See also W79-03906) (EIS-Deal)

W79-03919

**SIMULATION OF POTENTIAL POLLUTANT-CAUSED CHANGES IN THE ECOSYSTEM, RESULTING FROM THE SENSITIVITY OF AQUATIC ORGANISMS TO TOXICANTS, Moscow State Univ. (USSR). Faculty of Biology. N. S. Stroganov.**

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. 1, Environmental Protection Agency, Report EPA-600/3-78-076, p 152-160, 1978. 2 fig, 1 tab.

**Descriptors:** \*Simulation analysis, \*Toxicity, Bioassay, Chemical properties, Growth rates, Laboratory tests, Ecosystems, Aquatic environment, Resistance, Daphnia, Bacteria, Algae, Chlorella, Scenedesmus, Anabaena, Mollusks, Worms, Diptera, Water Pollution effects, Path of pollutants, \*Salicylanilide.

It is possible to simulate a complex ecosystem using a small volume, in which there are all of the basic components characteristic of natural aquatic communities. However, such a simulation is expensive, very time-consuming, and requires the equipping of a large experimental base. Another means of simulations could be based on laboratory tests and conducted according to a definite plan using representative organisms from basic functional groups which take part in the cycling of materials and of organisms which are of interest to industry. A representative experiment examining the toxicity of salicylanilide is presented. (See also V79-03906) (EIS-Deal)

W79-03920

**FISH-POPULATION STUDIES IN THE OHIO RIVER, W. C. Klein.**

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. 1, Environmental Protection Agency, Report EPA-600/3-78-076, p 161-165, 1978. 5 ref.

**Descriptors:** \*Fish populations, \*Ohio River, Fish establishment, Commercial fishing, Sport fishing, Channel improvement, Locks, Fish barriers, Water pollution effects, Canal construction, Carp, Municipal wastes, Industrial wastes, Flow control, Flow rates, Reservoirs, Canals, \*Species diversity.

A review of historical and recent information concerning fish in the Ohio River during 1957-60 and 1968-70 indicates that the composition of the fish population has changed during the period. In large measure, the changes can be attributed to the canalization of the river and increased pollution load. Although the pollution load has been decreased in recent years by the installation and operation of wastewater control facilities, the lake-like setting of the Ohio River continues to influence the kinds and numbers of fish in the river, as evidenced by the chemical fishing studies performed in the lock chambers. Although many of the so-called sport and commercial species have returned to the river, the fish species desiring a lake-like setting continue to dominate the populations. (See also W79-03908) (EIS-Deal)

W79-03921

**REGISTRATION OF PESTICIDES: CONSIDERATIONS IN CONDUCTING AQUATIC TOXICITY TESTS, For primary bibliographic entry see Field 5A.**

W79-03922

**EXPERIMENTAL RESEARCH ON PHENOL INTOXICATION OF AQUATIC ORGANISMS AND DESTRUCTION OF PHENOL IN MODEL COMMUNITIES, Akademiya Nauk SSSR, Moscow. Inst. Biologii Vnutrennykh Vod.**

M. M. Kamshilov, and B. A. Flerov.

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. 1, Environmental Protection Agency, Report EPA-600/3-78-076, p 181-192, 1978. 3 fig, 1 tab, 2 ref.

**Descriptors:** \*Phenols, \*Toxicity, Bacteria, Resistance, Chlorophyta, Chlorella, Diptera, Daphnia, Organic Compounds, Chemical reactions, Fertility, Fish reproduction, Fish behavior, Trout, Growth stages, Fish physiology, Model studies, Microbial degradation.

In the first part of the investigation, some particular and general problems of aquatic toxicity have been studied on a model of phenol intoxication of aquatic organisms. Among the problems investigated were comparative resistance of aquatic organisms, the role of biotic and abiotic factors in determining resistance effects of different concentrations of the toxicant on biological and physiological processes of aquatic organisms, and ability of organisms to adapt. In the second part of the investigation, destruction of phenol in different model ecosystems has been studied. (See also W79-03906) (EIS-Deal)

W79-03923

**HISTORY OF CHANGES IN FISH SPECIES OF THE GREAT LAKES, J. F. Carr.**

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. 1, Environmental Protection Agency, Report EPA-600/3-78-076, p. 193-218, 1978. 3 fig, 9 tab, 27 ref.

**Descriptors:** \*Great Lakes, \*Fish populations, Lake Erie, Lake Huron, Lake Superior, Lake Michigan, Lake Ontario, Industrial wastes, Chemical wastes, Municipal wastes, Productivity, Trophic level, Nutrients, Spawning, Biological communities, Lampreys, Salmonids, DDT, Pesticide residues, Phytoplankton, Zooplankton, Water quality, Water quality control, \*Species diversity, \*Tissue analysis.

The purpose of this paper was to discuss the changes which have taken place in the fish populations of the Great Lakes and the stresses which have caused these changes. The stresses which have been placed on the fish communities of the Great Lakes have been sequential and reflect and progress of man's occupation of the basin and his technological development. Physical, biological, chemical and thermal alterations, including exploitation, destruction of spawning grounds, oxygen depletion, increased water temperature, change in available food, and competition with introduced species, are discussed. (See also W79-03906) (EIS-Deal)

W79-03924

**SEA LAMPREY (PETROMYZON MARINUS LINNAEUS) IN THE SAINT LAWRENCE GREAT LAKES OF NORTH AMERICA: EFFECTS, CONTROL, RESULTS, C. M. Fetterolf, Jr.**

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. 1, Environmental Protection Agency, Report EPA-600/3-78-076, p. 219-226, 1978. 6 fig, 5 ref.

**Descriptors:** \*Lampreys, \*Great Lakes, \*Commercial fishing, \*Fish parasites, Lake Erie, Lake Superior, Lake Huron, Lake Michigan, Lake Ontario, Pesticides, Parasitism, Lake Trout, Bioassay, Pest control, Fish populations, \*Lampreicides, \*TFM, \*Bayer 73.

This paper outlines the history of the sea lamprey's existence in the Great Lakes Basin. Topics dis-

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

cussed include: life cycle; effects on commercial fishing; and efforts to develop an effective control program. (See also W79-03906) (EIS-Deal) W79-03925

#### TOXICITY TESTS IN THE REGULATION OF WASTE DISCHARGES IN THE UNITED STATES.

For primary bibliographic entry see Field 5A. W79-03926

#### TOXICOLOGICAL CONTROL OF POLLUTION OF FRESHWATERS,

Moscow State Univ. (USSR). Faculty of Biology.

For primary bibliographic entry see Field 5A.

W79-03927

#### TOXICITY OF EXPERIMENTAL FOREST INSECTICIDES TO FISH AND AQUATIC INVERTEBRATES,

For primary bibliographic entry see Field 5A.

W79-03928

#### PRINCIPLES AND METHODS OF BIOLOGICAL ESTABLISHMENT OF THE NORMS OF CHEMICAL SUBSTANCES AND EVALUATION OF THE LEVEL OF POLLUTION IN WATER-BODIES,

Tsentralnyi Nauchno-Issledovatel'skii Inst. Osetrovog Khozyaistva, Astrakhan (USSR).

For primary bibliographic entry see Field 5G. W79-03929

#### CHRONIC EFFECTS OF LOW LEVELS OF HYDROGEN CYANIDE ON FRESHWATER FISH,

L. L. Smith, Jr.

In: Proceedings of the First and Second USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. II, Environmental Protection Agency, Report EPA-600/3-78-076, p 39-54, 1978. 3 fig., 8 tab., 6 ref.

Descriptors: Bioassay, \*Toxicity, Mortality, \*Minnows, \*Brook trout, \*Hydrogen cyanides, Laboratory tests, Methodology, \*Cyanide toxicity, Water pollution effects, Industrial wastes, Growth rates, Growth stages, Chronic toxicity, Juvenile fish, Fecundity, Reproduction, Threshold concentration.

Chronic exposure tests of fathead minnows and brook trout indicates that safe level of HCN in the environment are much lower than the concentrations which will kill fish in short exposure. When there is continuous exposure of low levels of cyanide, some fish populations may be adversely affected by concentrations greater than 7-12 ug/liter. (See also W79-03906) (EIS-Katz) W79-03930

#### MICROBIOLOGICAL INDICES OF THE QUALITY OF WATER AND METHODS OF THEIR DETERMINATION,

Akademii Nauk SSSR, Moscow. Inst. Biologii Vnitrennykh Vod.

For primary bibliographic entry see Field 5A.

W79-03931

#### AMMONIA AND NITRITE TOXICITY TO FISHES,

R. C. Russo, and R. V. Thomann.

In: Proceedings of the First and Second USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. II, Environmental Protection Agency, Report EPA-600/3-78-076, p 75-82, 1978. 1 tab., 44 ref.

Descriptors: \*Ammonia, \*Nitrogen compounds, Nitrogen cycle, Sewage treatment, Toxicity, Mortality, Bioassay, Aquiculture, \*Water pollution effects, Rainbow trout, Freshwater fish reviews, Laboratory tests, Aqueous ammonia liberation system, \*Nitrites.

The literature regarding the toxicity of unionized ammonia and nitrites to fish is reviewed critically. (See also W79-03906) (EIS-Katz) W79-03932

#### A RESEARCH SYSTEM FOR DEVELOPING FISHERIES STANDARDS FOR WATER QUALITY, CONSIDERING THE PECULIARITIES OF TRANSFERRING EXPERIMENTAL DATA TO NATURAL WATER BODIES,

For primary bibliographic entry see Field 5G. W79-03933

#### COLLAGEN AND HYDROXYPROLINE IN TOXICOLOGICAL STUDIES WITH FISHES,

F. L. Mayer, and P. M. Mehrle.

In: Proceedings of the First and Second USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. II, Environmental Protection Agency, Report EPA-600/3-78-076, p. 92-101, 1978. 1 fig., 4 tab., 26 ref.

Descriptors: \*Fish physiology, \*Biochemistry, \*Protein, \*Enzymes, Water pollution effects, Animal pathology, Chlorinated hydrocarbon pesticides, Insecticides, Toxaphene, \*Collagen, \*Hydroxyproline, Toxicity, Toxicological studies, Growth, Bone development, Backbone development, \*Collagen formation, Vitamin C.

Biochemical characteristics such as hydroxyproline and collagen concentrations in bone can be used as indicators, and within limits, predictors of growth in fish thereby shortening chronic toxicity tests. Although growth can be directly related to collagen and hydroxyproline metabolism in fish, the mechanism by which growth is reduced is not known. Other biochemical processes requiring vitamin C could also be affected when large amounts of the vitamin are used by the liver in detoxication of organic contaminants through microsomal hydroxylative enzymes. (See also W79-03906) (EIS-Katz) W79-03934

#### EXPERIMENTAL TESTING OF TOXICITY OF WATER MEDIA AND INCREASING OF THE SENSITIVITY OF BIOLOGICAL TESTS,

For primary bibliographic entry see Field 5A. W79-03935

#### CHRONIC EFFECTS OF LOW LEVELS OF HYDROGEN SULFIDE ON FRESHWATER FISH,

L. L. Smith, Jr.

In: Proceedings of the First and Second USSR Symposia on the Effects of the Pollutants Upon Aquatic Ecosystems - Vol. II, Environmental Protection Agency, Report EPA-600/3-78-076, p. 113-121, 1978. 6 tab., 8 ref.

Descriptors: \*Hydrogen sulfide, \*Toxicity, Mortality, Bioassay, Fresh water fish, Laboratory test, \*Toxic concentrations, Chronic effects, Brook trout, Bluegill sunfish, Fathead minnow, Goldfish, Threshold toxicity, Growth aquaculture, LC50.

Comparison of LC50 levels of hydrogen sulfide with those which have adverse effects after long exposure indicates that the 96-hr LC50 may be 3 to 8 times higher than the safe levels. The present work, and that of Smith and Oseid (1974), who examined the effect of hydrogen sulfide on early life history stages of 8 species of freshwater fish, show that a safe level of hydrogen sulfide which will insure survival and growth of a fish population, and adequate survival of all life history stages will generally be between 0.002 and 0.004 mg/l at 20 degree C. In bluegills, the level is significantly lower, and this pattern may be followed in other species not tested. (See also W79-03906) (EIS-Katz) W79-03936

#### THE BEHAVIORAL ASPECTS OF AQUATIC TOXICOLOGY,

B. A. Flerov.

In: Proceedings of the First and Second USA-

USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. II, Environmental Protection Agency, Report EPA-600/3-78-076, p. 122-132, 1978. 2 fig., 2 tab., 48 ref.

Descriptors: \*Fish behavior, \*Bioassay, Toxicity, Mortality, Fresh water fish, Phenols, Insecticides, Pesticides, Pulp and paper industry, Lotos-71, Polychloroprene, Chlorophos, Avoidance reaction, Intoxication, Conditioned reflex activity, Aquiculture, Sublethal effects, Aquatic toxicology.

The behavioral responses of aquatic organisms to changes in water quality are reviewed. Some of these responses are disturbances of the equilibrium reflex, violent behavior, increase in general excitability, abundant excretion of mucus, and avoidance reactions and adaptation. (See also W79-03906) (EIS-Katz) W79-03937

#### GEOLOGIC POLLUTION PROBLEMS OF LAKE SUPERIOR,

For primary bibliographic entry see Field 5B. W79-03938

#### EXPERIMENTAL APPLICATION OF VARIOUS SYSTEMS OF BIOLOGICAL INDICATION OF WATER POLLUTION,

For primary bibliographic entry see Field 5A. W79-03939

#### STRUCTURAL AND FUNCTIONAL CHARACTERISTICS OF SESTON AS INDICES OF WATER POLLUTION,

For primary bibliographic entry see Field 5A. W79-03940

#### ENVIRONMENTAL EFFECTS OF OIL SHALE MINING AND PROCESSING, PART 1: FISHES OF PICEANCE CREEK, COLORADO, PRIOR TO OIL SHALE PROCESSING,

Colorado Div. of Wildlife, Fort Collins. Fisheries Research Center.

J. P. Goettl, and J. W. Edde.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-289 874, Price codes: A03 in paper copy, A01 in microfiche, Report No. EPA-600/3-78-096, October 1978. 24 p., 1 fig., 1 tab., 29 ref. R803950.

Descriptors: \*Fishes, \*Fish populations, \*Piceance Creek (Colorado), \*Oil shales, Water pollution, Environmental effects, Fish migration, Fish reproduction, Surveys, Freshwater fish, Brook trout, Bullheads, Brown trout, Sampling.

A survey was made of the fish populations of Piceance Creek, Colorado, to establish existing conditions prior to anticipated extensive oil shale processing in the area. Thirteen species of fishes have been reported to occur in Piceance Creek; eight of them were recovered in this sampling. The mountain sucker and the speckled dace were the most numerous and widespread. Salmonids were most abundant at the three upper sampling stations of the creek, and brook trout were found in both tributaries. Population estimates of the mountain sucker were 61 and 36 fishes/100 m of stream of stations PC-2 and PC-3 during 1976. Survey results indicate that brook trout and brown trout are reproducing naturally in the creek, but rainbow trout are doing poorly. Species introduced from other drainages and the effects of creek alterations and agricultural diversions have produced changes in the fish fauna of this creek. Data reported in earlier research have been compared to data collected in this survey. Potential impacts of oil shale processing on the fish population of Piceance Creek are discussed. (See also W79-03975) (Davidson-IPA) W79-03974

#### ENVIRONMENTAL EFFECTS OF OIL SHALE MINING AND PROCESSING, PART II: THE AQUATIC MACROINVERTEBRATES OF THE

PICEANCE  
OIL SHALE  
Colorado  
Geology; and  
Dept. of L. J. Gray

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## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Effects Of Pollution—Group 5C

#### PICEANCE BASIN, COLORADO, PRIOR TO OIL SHALE PROCESSING.

Colorado State Univ., Fort Collins. Dept. of Zoology; and Colorado State Univ., Fort Collins. Dept. of Entomology.

L. J. Gray, and J. V. Ward.

Descriptors: \*Benthos, \*Aquatic biota, \*Streams, \*Piceance Basin(Colorado), Environmental effects, Oil shales, Streamflow, Sampling, Biomass, Biota, Water pollution, Tributaries, Downstream, Upstream, Sediments, Aquatic life.

A study of the benthic macroinvertebrate communities on four streams in the Piceance Basin of north-western Colorado prior to oil shale mining and processing is reported. Environmental conditions varied longitudinally along the Piceance Creek, the major stream studied. The downstream direction showed greatly increased amount of total dissolved solids, sodium, sulfate and chloride. It also exhibited increases in temperature range, turbidity, severity of winter ice conditions, and effects of grazing and irrigation activities. Winter species of fauna inhabit the upstream areas of the creek, and its tributaries, while summer species inhabit the downstream regions. Of the 83 total macroinvertebrates collected only two were common at all sites indicating that these species are tolerant of a widely varying physical and chemical conditions which exist. The fauna of Black Sulphur Creek was generally similar to the middle Piceance sites, and Willow Creek fauna closely resembled Black Sulphur Creek fauna. A discussion of the impact of mining on this creek and its tributaries is general in nature, because the effects will depend on the types of extraction and processing to be used and the steps taken to protect the stream environment. (See also W79-03974) (Davison-IPA)

W79-03975

#### EVALUATING THE SAMPLING FREQUENCIES OF WATER QUALITY MONITORING NETWORKS.

Colorado State Univ., Fort Collins. Dept. of Agriculture and Chemical Engineering.

R. C. Ward, and K. S. Nielsen.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 367, Price codes: A03 in paper copy, A01 in microfiche. Final Report No. EPA-600/7-78-169, August 1978. 40 p, 1 fig, 4 tab, 10 ref, 1 append. CB-6-99-2530-A.

Descriptors: \*Water sampling, \*Water quality control, \*Data collections, \*Networks, \*Sampling frequencies, Water analysis, Water quality, Monitoring, Design criteria, Water quality standards, Human population, Data storage and retrieval, STORET, Colorado, Minnesota.

A simple easy to use procedure for evaluating sampling frequencies in a routine fixed-station, water-quality monitoring network used for regulatory water-quality management purposes is presented. Evaluation of a regulatory water-quality monitoring system involves examining: sampling station locations, parameter coverage, and sampling frequencies. The procedure uses data currently in the Environmental Protection Agency's STORET inventory routine to compute the sample statistics, based on the assumption that each parameter follows the normal distribution: these sample statistics are then assumed to represent the population parameters. The population parameters are used to examine the uniformity and size of the precisions about water quality mean. The evaluation procedure is demonstrated with data from the Colorado and Minnesota state water-quality management programs. It is recommended that future work in network design and data analysis be closely coordinated with the STORET system. (Davison-IPA)

W79-03976

#### DISTRIBUTION OF PHYTOPLANKTON IN ILLINOIS LAKES.

Nevada Univ., Las Vegas. Dept. of Biological Sciences.

M. K. Morris, L. R. Williams, W. D. Taylor, F. A. Hiatt, and S. C. Hern.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-285 411, Price codes: A07 in paper copy, A01 in microfiche. EPA-600/3-78-050, May 1978. 128 p, 3 tab, 11 ref, 1 append.

Descriptors: \*Illinois, \*Phytoplankton, \*Trophic level, \*Eutrophication, \*Water quality indices, \*Data collections, \*National eutrophication survey, \*Baseline studies, Bioindicators, Algae, Reservoirs, Distribution, Species diversity, Diversity indices, Species composition, Floral lists.

Phytoplankton species composition and abundance were determined for 31 Illinois lakes and reservoirs; in addition, the trophic status was assessed by means of several water quality indices, including Nygaard's five trophic state indices, Palmer's organic pollution indices, the Brillouin and Shannon/Weaver species diversity indices, and abundance indices. The study was conducted spring, summer, and fall 1973 as part of the National Eutrophication Survey. Lakes were selected on the basis of actual or potential accelerated eutrophication problems as measured by three criteria: (1) contamination by sewage treatment plant effluent, (2) surface area of at least 40 ha, and (3) hydraulic retention time of at least 30 days. Lakes surveyed: Bloomington, Carlyle, Charleston, Decatur, Lou Yaeger, Marie, Shelbyville, Springfield, Story, Sanchris, Holiday, We-Ma-Tuk, and Vandalia; Coffeen, Crab Orchard, Long, Piskee, Rend, Highland, Vermilion, Wonder, Depue, Fox, Grass, East Loon, Slocum, Cedar, Raccoon, Baldwin, and Horsehoe Lakes; and Old Ben Mine Reservoirs. Data are summarized by lake in an appendix containing alphabetical lists of phytoplankton species with concentrations of each by sampling date, and results of application of the indices. Nygaard's indices are based on algal groups known to be unique to eutrophic or oligotrophic waters. (Lynch-Wisconsin)

W79-03989

#### DISTRIBUTION OF PHYTOPLANKTON IN NORTH CAROLINA LAKES.

Nevada Univ., Las Vegas. Dept. of Biological Sciences.

M. K. Morris, L. R. Williams, W. D. Taylor, F. A. Hiatt, and S. C. Hern.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 387, Price codes: A05 in paper copy, A01 in microfiche. EPA-600/3-78-051, May 1978. 73 p, 3 tab, 11 ref.

Descriptors: \*North Carolina, \*Lakes, \*Phytoplankton, \*Trophic level, \*Eutrophication, \*Water quality indices, \*Data collections, \*National eutrophication survey, \*Baseline studies, Bioindicators, Algae, Reservoirs, Distribution, Species diversity, Diversity indices, Species composition, Floral lists.

Phytoplankton species composition and abundance were determined for 16 North Carolina lakes and reservoirs; in addition, the trophic status was assessed by means of several water quality indices, including Nygaard's five trophic state indices, Palmer's organic pollution indices, the Brillouin and Shannon/Weaver species diversity indices, and abundance indices. The study was conducted spring, summer, and fall 1973 as part of the National Eutrophication Survey. Lakes were selected on the basis of actual or potential accelerated eutrophication problems as measured by three criteria: (1) contamination by sewage treatment plant effluent, (2) surface area of at least 40 ha, and (3) hydraulic retention time of at least 30 days. Lakes surveyed were Badin, Blewett Falls, Fontana, Hickory (Lake Oxford), High Rock, Hiwassee, James, Junaluska, Lookout Shoals, Mount Island, Norman, Rhodhiss, Santeetlah, Tillery, Waterville and Waccamaw. Data are summarized by lake in an appendix containing alphabetical lists of phytoplankton species with concentrations of each by sampling date, and results of application of the indices. Nygaard's indices are based on algal groups known to be unique to eutrophic or oligotrophic waters. Palmer indices incorporate two lists of organic pollution-tolerant taxa, one with 20 genera, and one with 20 species. (Lynch-Wisconsin)

W79-03990

#### DISTRIBUTION OF PHYTOPLANKTON IN INDIANA LAKES.

Nevada Univ., Las Vegas. Dept. of Biological Sciences.

F. A. Morris, M. K. Morris, L. R. Williams, W. D. Taylor, and F. A. Hiatt.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 352, Price codes: A05 in paper copy, A01 in microfiche. EPA-600/3-78-078, August 1978. 70 p, 3 tab, 11 ref, 1 append.

Descriptors: \*Indiana, \*Lakes, \*Phytoplankton, \*Trophic level, \*Eutrophication, \*Water quality indices, \*Data collections, \*National eutrophication survey, \*Baseline studies, Bioindicators, Algae, Reservoirs, Distribution, Species diversity, Diversity indices, Species composition, Floral lists.

Phytoplankton species composition and abundance were determined for 27 Indiana lakes and reservoirs; in addition, the trophic status was assessed by means of several water quality indices, including Nygaard's five trophic state indices, Palmer's organic pollution indices, the Brillouin and Shannon/Weaver species diversity indices, and abundance indices. The study was conducted spring, summer, and fall 1973 as part of the National Eutrophication Survey. Lakes were selected on the basis of actual or potential accelerated eutrophication problems as measured by three criteria: (1) contamination by sewage treatment plant effluent, (2) surface area of at least 40 ha, and (3) hydraulic retention time of at least 30 days. Lakes surveyed: Cataracl, James, Wawasee, Webster, Whitewater, Winona, Wester, Witmer, Tippecanoe, Dallas, Olin, Oliver, Sylvan, Hovey, Versailles, Bass, Crooked, Long, Pigeon, Marsh, Hamilton, Maxinkuckee and James; and Geist, Mississinewa, Monroe, and Morse Reservoirs. Data are summarized by lake in an appendix containing alphabetical lists of phytoplankton species with concentrations of each by sampling date, and results of application of the indices. Nygaard's indices are based on algal groups known to be unique to eutrophic or oligotrophic waters. Palmer indices incorporate two lists of organic pollution-tolerant taxa, one with 20 genera, and one with 20 species. (Lynch-Wisconsin)

W79-03991

#### INORGANIC SPECIES IN WATER: ECOLOGICAL SIGNIFICANCE AND ANALYTICAL NEEDS, A LITERATURE REVIEW.

Environmental Research Lab., Athens, GA.

T. B. Hoover.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 945, Price codes: A06 in paper copy, A01 in microfiche. EPA-600/3-78-064, July 1978. 99 p, 2 fig, 518 ref.

Descriptors: \*Reviews, \*Bibliographies, \*Inorganic compounds, \*Pollutants, \*Toxicity, \*Water pollution effects, Chemicals, Heavy metals, Arsenic, Chromium, Lead, Mercury, Selenium, Absorption, Aquatic plants, Aquatic animals, Public health, Algae, Fish, Sublethal effects, Path of pollutants, Bioaccumulation, Analytical techniques, Water bodies, Speciation, Rivers, Lakes, Oceans, Estuaries, Impounds.

A literature review of environmental significance of inorganic chemical species (as opposed to total element content) in water emphasizes effects on human health and on plant and animal life. The bibliography lists 518 works, giving special attention to recent U.S. Government reports and conference proceedings. The role of valence state, ionization, complexation, and absorption in the transport and cycling of elements are considered, together with factors affecting distribution of elements and species in freshwater streams and impounds, and in estuaries and the sea. Information on chronic effects on human health of trace inorganic pollutants is almost entirely limited to total elements because of lack of an adequate methodology to distinguish among forms of an element. Of greatest concern with respect to toxicity of



## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Waste Treatment Processes—Group 5D

Environmental Protection Agency, Cincinnati, OH. Office of Technology Transfer.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 455, Price codes: A02 in paper copy, A01 in microfiche. Report No. EPA/625/2-73/003, August 1973. 13 p, 6 fig, 2 tab.

Descriptors: \*Waste water treatment, \*Water pollution control, \*Copper, Copper alloys, Industrial wastes, Chemical wastes, Effluents, Water quality control, Industrial water, Electrolysis, Comparative costs, Liquid wastes, Solid wastes, Water conservation.

A process for reducing water consumption in copper wire mills by 90% is described. The process consists of three basic steps: (1) regeneration and copper recovery system for the primary picking; (2) chemical rinse; and (3) a secondary picking using hydrogen peroxide and proprietary additives. High purity metallic copper was recovered from the regenerated sulfuric acid pickle through continuous electrolysis. Plant water consumption was reduced from 200,000 gallons per day to 20,000 gallons per day, and total solids leaving the plant were reduced from 2500 lbs per day to less than 100 lbs per day. Estimated annual savings of this pollution abatement program compared to a waste treatment only program were \$163,000 or \$2.61 per finished ton of wire, based on 6,000 hours of operation per year of a 62,500 ton capacity plant. Five installations manufacturing copper and copper alloy products are currently using this process. This chemical rinse technique is also applicable to electroplating operations. (Davison-IPA)

W79-03572

#### COLOR REMOVAL FROM KRAFT PULPING EFFLUENT BY LIME ADDITION.

Environmental Protection Agency, Cincinnati, OH. Office of Technology Transfer.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 135, Price codes: A02 in paper copy, A01 in microfiche. Report No. EPA/625/2-73/002, April 1973. 13 p, 7 fig, 2 tab.

Descriptors: \*Water pollution control, \*Color, \*Industrial wastes, \*Waste water treatment, \*Pulp wastes, Pulp and paper industry, Sedimentation, Lime, Neutralization, Separation techniques, Waste storage, Water purification, Pilot plants, Sludge.

The operation of a full scale process for lime decolorization of kraft pulping total mill effluent is discussed. Slaked lime was applied to the total mill effluent, and during primary sedimentation mixed fibrous and lime decolorization sludges were removed. The effluent was then stored in basin where biochemical stabilization took place. Excessive lime alkalinity was neutralized in the basin by absorption of atmospheric carbon dioxide. A pilot-scale study of recarbonation for enhanced lime separation and more rapid effluent neutralization prior to biochemical stabilization to obtain preliminary design data is discussed. Potential savings of raw material by recovery of the lime used is estimated at \$78,000 annually. (Davison-IPA)

W79-03573

#### A FEASIBILITY STUDY OF RESPONSE TECHNIQUES FOR DISCHARGES OF HAZARDOUS CHEMICALS THAT DISPERSE THROUGH THE WATER COLUMN.

Little (Arthur D.), Inc., Cambridge, MA. E. Drake, D. Shooter, W. Lyman, and L. Davison.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A040 968, Price codes: A12 in paper copy, A01 in microfiche. Final Report No. CG-D-16-77, July 1976. 254 p, 27 fig, 51 tab, 39 ref, 4 append. DOT-CG-51122-A.

Descriptors: \*Water pollution treatment, \*Spills, \*Chemicals, \*Hazards, Chemical wastes, Neutralization, Solvent extractions, Precipitation, Chela-

tion, Water chemistry, Water properties, Water treatment, Waste treatment.

The feasibility of treating hazardous chemical spills which are soluble in water was investigated. Four different methods were examined in detail as response techniques for ameliorating these spills: neutralization, solvent extraction, precipitation, and chelation. For each technique, the principles are described, requirements for alleviating the ecological impact of the spill are presented, the rationale for the screening of potential agents is discussed, and the most appropriate agents are selected. The potential application methods of the preferred agents are described, and the environmental considerations of both the effects of the spilled chemical and the application of the agent are discussed. It is concluded that neutralization seems feasible and practical for treating spilled chemicals which are acids and bases; sodium bicarbonate is recommended for acids, sodium dihydrogen phosphate for bases; solvent extraction is feasible but has practical limitations; vegetable oil is the most satisfactory solvent agent; chemicals ameliorated by precipitation contain cations and anions, so that a single agent is not effective for both types; chelation is limited in applicability to the same chemicals considered for precipitation. (Davison-IPA)

W79-03578

#### PHARMACEUTICAL INDUSTRY: HAZARDOUS WASTE GENERATION, TREATMENT, AND DISPOSAL.

Environmental Protection Agency, Washington, DC. Office of Solid Waste Management Programs. Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 800, Price codes: A09 in paper copy, A01 in microfiche. Report No. EPA/SW-508, 1976. 190 p, 19 fig, 62 tab, 69 ref, 2 append.

Descriptors: \*Waste treatment, \*Pharmaceutical industry, \*Waste disposal, \*Industrial wastes, Hazards, Fermentation, Incineration, Landfills, Organic wastes, Effluents, Biochemical oxygen demand, Costs, Cost analysis, Basic data collections, Surveys, Solid wastes, Water pollution control, Surveys.

Studies were made to provide the Environmental Protection Agency (EPA) with: (1) a data base concerning the current and projected types and amounts of industrial waste and applicable disposal methods and costs; (2) a data base for technical assistance activities; and (3) a background for development work as required by the Solid Waste Disposal Act as amended. The basic objectives of this study were: (1) to determine the characterization of pharmaceutical industry wastes (1973), and to project these wastes to 1977 and 1983; (2) to define the current treatment and disposal practices within the industry; (3) to investigate improved control technologies potentially applicable in reducing the hazards of these wastes; and (4) to calculate costs for the implementation of three levels of control technology in a hypothetical or existing plant. Information concerning research and development, biological products, fermentation, organic synthetics, extraction of animal glands, and formulation and packaging operations was extrapolated from surveys conducted during site visits. Eight landfills and four contractors treating wastes by incineration were visited. It is expected that quantities of hazardous and nonhazardous wastes will increase proportionately with production with no significant effect of air and water guidelines for 1977 and 1983. About 5,600 metric tons of hazardous wastes and 150,000 metric tons of total wastes are finally disposed of on land in secure chemical landfills or are encapsulated. Generalized costs of treatment are summarized, and costs for 'end-of-pipe' treatment and disposal of each hazardous waste are calculated. (Davison-IPA)

W79-03579

#### ISSUES IN WASTE WATER TREATMENT FACILITY LOCATION.

Rutgers - The State Univ., New Brunswick, NJ. Dept. of Urban Planning and Policy Development.

For primary bibliographic entry see Field 5G. W79-03594

#### FLUORIDE REMOVAL AND RELEASE BY ALUMINUM SULFATE FLOC.

Auburn Univ., AL. Dept. of Civil Engineering. J. B. Thomas, Jr.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 562, Price codes: A10 in paper copy, A01 in microfiche. M.S. Thesis, 1975. 89 p, 13 fig, 16 tab, 54 ref, append. OWRT A-043-ALA(2).

Descriptors: \*Fluorides, \*Alum coagulation, Sludge storage, \*Water treatment, \*Waste treatment, Hydrogen ion concentration, \*Coagulation, \*Turbidity, Alkalinity, Fluoride content.

An experimental investigation was conducted to determine the amount of previously added fluoride removed during alum coagulation. The effects of time, turbidity, pH and amount of fluoride addition were examined and various methods for determining different forms of fluoride were investigated. Furthermore, the release of fluoride during sludge storage was studied. Turbid water samples of known turbidity, alkalinity and fluoride content were coagulated with alum by the standard jar test procedure, and analyzed for residual fluoride and aluminum content. Greatest fluoride removal occurred at pH 6.5 and carryover aluminum concentrations were found to correspond directed to optimum alum doses. A method for measuring complexed and uncomplexed forms of fluoride was attempted. Sludge samples were placed in plastic bottles and stored in the laboratory. Supernatant from these bottles was collected at monthly intervals and over a five month period the fluoride content of the supernatant was found to change. Bottom samples were collected at various points along Wilmore Creek which receives sludge discharges from the Auburn Water Treatment Plant. The samples were found to decrease in fluoride content with increasing distance from the point of sludge discharge. (W79-03677)

#### INSECT PEST PROBLEMS ASSOCIATED WITH WASTEWATER OXIDATION LAKES IN MICHIGAN.

Michigan State Univ., East Lansing. Dept. of Entomology.

For primary bibliographic entry see Field 5G.

W79-03684

#### BIOLOGICAL AND ECOLOGICAL STUDIES ON THE INTERACTION OF *BDELOVIBRIO* AND *ENTEROBACTERIACEAE*.

Auburn Univ., AL.

For primary bibliographic entry see Field 5C.

W79-03691

#### NOTE ON THE FERTILITY VALUE OF OXIDATION POND EFFLUENT FOR GROUND-NUT (*ARACHIS HYPOGAEA* L.).

Central Public Health Engineering Research Inst., Nagpur (India).

C. K. Kale.

Indian Journal of Agricultural Science, Vol. 43,

No. 5, p 523-525, May, 1973. 2 tab, 4 ref.

Descriptors: \*Legumes, \*Phosphorus, Effluents, \*Oxidation lagoons, Nutrients, \*Sewage treatment, \*Fertilizers, \*Waste water treatment, Waste treatment, Water reuse, \*Groundnut(*Arachis hypogaea* L.), \*India.

The value of domestic sewage as a fertilizer was tested at an oxidation pond, using groundnut as the test plant. Seven treatments were used, including a tap-water control. N, P, and K concentrations of the fertilizers are given. The effect of different treatments on root growth was significant at 5 percent level. Synthetic sewage and control gave similar results. The effect of irrigation treatments on the vegetative growth of the groundnut was significant at the 1 percent level. Although the addition of phosphorus to this effluent gave a

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

better yield, the increase over the effluent alone was not significant. It is believed that the shortage of phosphorus in comparison to nitrogen and potassium in the raw sewage and effluent was compensated for by other nutrient elements, including microelements. (Carpenter-FIRL)  
W79-03696

**WATER SYSTEM VIRUS DETECTION,**  
National Aeronautics and Space Administration  
Washington, DC. (Assignee).  
For primary bibliographic entry see Field 5A.  
W79-03784

**SYSTEM FOR POLLUTION SUPPRESSION,**  
TII Corp., Lindenhurst, NY. (Assignee).  
E. T. Armstrong.  
U.S. Patent No. 4,119,273, 12 p, 14 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 975, No 2, p 589, October 10, 1978.

Descriptors: \*Patents, \*Waste water treatment, \*Sewage treatment, \*Water pollution treatment, Equipment, Anaerobic conditions, Trickling filters, Distribution.

A rotary arm distributor apparatus distributes an equal amount of liquid for each unit area of an apparatus such as a trickling filter. The rotary distributor arm comprising improved distribution nozzles and flow control accomplished by a gradual taper of the arm itself is defined which ensures a uniform flow distribution across the full radius of the distributing medium so that uniformity and optimum economy and efficiency are achieved with respect to the trickling filter itself because a uniform fluid flow is distributed across the entire top surface. (Sinha—OEIS)  
W79-03788

**METHOD OF DISPOSING OF A FERROUS-ION CONTAINING ACIDIC AQUEOUS WASTE FOR FORMING POLYCRYSTALLINE IRON COMPOUND PARTICLES,**  
Nippon Electric Co. Ltd., Tokyo. (Assignee).  
K. Iwase, T. Takada, and M. Kiyma.  
U.S. Patent No. 4,119,536, 3 p, 10 ref, Official Gazette of the United States Patent Office, Vol 975, No 2, p 671, October 10, 1978.

Descriptors: \*Patents, \*Waste water treatment, \*Industrial wastes, \*Water pollution treatment, Separation techniques, Iron compounds, Chemical precipitation, Acidic water.

Acidic waste including ferrous or bivalent iron ions, for example, the waste lye of a pickle for articles made of iron and a waste that inevitably results during production of titanium white includes, besides the ferrous ions, either halogen or sulfate ions and is strongly acidic. On disposing of the acidic waste the ferrous ions are oxidized to produce iron compound precipitate in a remaining waste liquid. With the temperature of the waste kept between 50 degrees C and 75 degrees C and with pH of the waste liquid adjusted between 3.5 and 5.2, fine particles of the iron compound otherwise produced agglomerate into large polycrystalline particles. The large particles are readily separated from the waste liquid, which is now substantially neutral and transparent. (Sinha—OEIS)  
W79-03790

**TREATMENT OF WASTE LIQUID AND APPARATUS THEREFOR AND A FERTILIZER COMPOSITION OBTAINED THEREBY,**  
Nittetu Chemical Engineering Ltd., Tokyo (Japan). (Assignee).  
T. Yamauchi, M. Akune, and S. Kouchi.  
U.S. Patent No. 4,119,538, 6 p, 1 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 975, No 2, p 671, October 10, 1978.

Descriptors: \*Patents, \*Waste water treatment, \*Industrial wastes, Organic wastes, Inorganic compounds, Incineration, Fertilizers, Concentration, Fermentation industry.

A process for treating a waste liquid which is obtained from a fermentation process, e.g., an alcohol fermentation, and contains organic and inorganic substances which are useful as fertilizer, is provided. The process includes combusting a concentrate of the waste liquid and bringing the combustion products containing the ashes which are formed from the inorganic substances and the hot combustion gases into direct contact with a fresh portion of the waste liquid. The liquid is concentrated by evaporation and a slurry of the ashes in the concentrated waste liquid is formed. The slurry is separated into a solid sediment containing the minerals and a part of the organic components of the liquid. By drying the sediment with agitation, a granulate which can be used as a fertilizer can be produced. (Sinha—OEIS)  
W79-03792

**COMBINED FILTER AND INCINERATOR,**  
Thiokol Corp., Newtown, PA. (Assignee).  
D. P. Clark, and W. F. Wagner.  
U.S. Patent No. 4,120,792, 4 p, 4 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 975, No 3, p 1102, October 17, 1978.

Descriptors: \*Patents, \*Waste water treatment, Water pollution treatment, Water pollution control, \*Filtration, \*Incineration, \*Filters, Solid wastes, Ships.

An enclosure having an inlet and an outlet for hot air, and an inlet and an outlet for waste water, contains a number of refractory, porous, tubular, membrane-type filters, each of which is closed at one end and connected at its other end to the waste water outlet. Hence, waste water entering through its inlet in the enclosure must pass through the walls of the filter tubes before being discharged through its outlet. During this process, any solid particles in the water become deposited on the outer surfaces of the filter tubes. After a filtering cycle is over and the waste water has been drained through its outlet, heating means, equipped with a blower and attached to the hot-air inlet, forces heated air into the enclosure to incinerate the solids deposited on the filter tubes. Therefore, the filter tubes serve also as refractory grates to hold the sludge while it burns. After the sludge has been burned, an automatic timer switches back to the filtering cycle. (Sinha—OEIS)  
W79-03797

**ECONOMIC ANALYSIS, ROOT CONTROL, AND BACKWATER FLOW CONTROL AS RELATED TO INFILTRATION/INFLOW CONTROL,**  
American Public Works Association, Chicago, IL.  
For primary bibliographic entry see Field 5G.  
W79-03841

**THE EFFECT OF SEWAGE (MECHANICALLY, BIOLOGICALLY, AND CHEMICALLY TREATED) ON ALGAL GROWTH,**  
Vandkvalitetsinstitut, Hoersholm (Denmark).  
For primary bibliographic entry see Field 5C.  
W79-03854

**MONITORING THE EFFECTS OF CHEMICAL AND BIOLOGICAL WASTE WATER TREATMENT IN SITU BY DIALYSIS CULTURES OF FRESHWATER ALGAE,**  
Bergen Univ. (Norway). Inst. for General Microbiology.  
For primary bibliographic entry see Field 5A.  
W79-03883

**MODELING OF N- AND P- UPTAKE BY SCENEDESMUS ACUTUS, WITH REGARD TO TERTIARY TREATMENT OF DOMESTIC WASTE WATER,**  
Ghent Rijksuniversiteit (Belgium). Faculteit Landbouwwetenschappen.  
For primary bibliographic entry see Field 5C.  
W79-03885

### RESEARCH ON THE TERTIARY TREATMENT OF SWINE MANURE BY MASS CULTURING OF ALGAE,

Ghent Rijksuniversiteit (Belgium). Lab. for Biological Research in Environmental Pollution. N. De Pauw, E. Bruggeman, and G. Persoone. In: Symposium Experimental use of Algal Culture in Limnology, 26-28 October 1976, Sandefjord, Norway. Internationale Vereinigung für Theoretische und Angewandte Limnologie, Mitteilungen No. 21, June 1978, p 490-506, 4 fig, 3 tab, 27 ref.

Descriptors: \*Manure, \*Hogs, \*Tertiary treatment, \*Algae, \*Waste treatment, \*Farm wastes, \*Nutrient removal, Livestock, Cultures, Semicontinuous cultures, Batch cultures, Phytoplankton, Chlorophyta, Scenedesmus acutus var. alternans Chlorella vulgaris, Coelastrum proboscideum, Nutrients, Nitrogen, Phosphorus, Carbon dioxide, Hydrogen ion concentration, Beneficial use, Bioassay, Belgium, Raceways, Biochemical oxygen demand.

Laboratory and outdoor (raceway) experiments in Belgium demonstrated the feasibility of tertiary treatment of swine manure by mass culturing of three species of chlorophytic algae. Laboratory assays with the algae (Scenedesmus acutus var. alternans, Chlorella vulgaris and Coelastrum proboscideum) showed that both diluted and undiluted aerated swine manure constitute excellent substrates for the algae, yielding several grams dry algae per liter of waste. Addition of carbon dioxide to the cultures for pH stabilization resulted in much better algal growth. In the outdoor raceways (with paddles) satisfactory algal growth was achieved with diluted waste, except during winter when temperatures are too low and day length too short. During spring and summer yields of over 10 g/sq m/day were obtained. Nitrogen and phosphorus were generally reduced more than 90%. Addition of carbon dioxide had little or no effect on nutrient elimination. With control of nutrient input based on calculation of the theoretical yield under prevailing light conditions, good results can be obtained, and the algal biomass may be harvestable as a cheap food protein source. Stock cultures were maintained at high concentrations on solid (agar) and liquid media, and batch cultures for inoculation to the raceways were preadapted to swine manure by addition of 5% swine effluent to the artificial medium. Manure was subjected to secondary treatment before the experiments. (See also W79-03842) (Lynch-Wisconsin)  
W79-03886

**REUSE OF TREATED FRUIT PROCESSING WASTEWATER IN A CANNERY,**  
Snokist Growers, Yakima, WA.  
For primary bibliographic entry see Field 3E.  
W79-03966

**ASSESSMENT OF POTENTIAL TOXIC RELEASES FROM LEATHER INDUSTRY DYEING OPERATIONS,**  
SRI International, Menlo Park, CA.  
For primary bibliographic entry see Field 5B.  
W79-03972

**STATE-OF-THE-ART REPORT: PESTICIDE DISPOSAL RESEARCH,**  
Midwest Research Inst., Kansas City, MO.  
For primary bibliographic entry see Field 5E.  
W79-03986

**BIODEGRADATION STUDIES OF CARBOXY-METHYL TARTRONATE,**  
Municipal Environmental Research Lab., Cincinnati, OH. Wastewater Research Div. E. F. Barth, H. H. Tabak, and C. I. Mashni. Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 970. Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency, EPA 600/2-78-115 July 1978. 34 p, 6 tab, 7 fig, 25 ref.

Descriptors: \*Activated sludge, \*Biodegradation, Laboratory tests, \*Waste treatment, Waste water disposal, Waste water pollution, Laboratory tests.

Micro method Biomas

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5E. U

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BIOGA Municipati, OH. C. A. C. News of Septem

Descrip \*Ultimate digestion Farm v Sludge wastes.

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## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Ultimate Disposal Of Wastes—Group 5E

ALLOCATIONAL INEFFICIENCY OF WASTES IN THE ENVIRONMENT. (See also Water Quality Control—Field 5C.)

**THE EFFECTS OF SPARY IRRIGATION ON A MIXED FOREST ECOSYSTEM,**  
New Hampshire Univ., Durham. Dept. of Botany.  
For primary bibliographic entry see Field 5C.  
W79-03679

Carboxymethyl tartrate (CMT) was shown to be biodegradable in bench-scale activated sludge reactors. After initial exposure to CMT in continuous flow systems an acclimation period of 14 weeks was necessary before efficient degradation occurred. Once acclimated to CMT the biomass could be starved in regard to this substrate for at least 1.6 times the sludge age and still retain capacity to degrade the material upon re-introduction. Activated carbon was not found to be effective for CMT removal at a pH value of 7. (EIS-Katz)

Microorganism, Municipal wastes, Analytical methods, Methodology, Gas chromatography, Biomass, \*Carboxymethyl tartrate.

Carboxymethyl tartrate (CMT) was shown to be biodegradable in bench-scale activated sludge reactors. After initial exposure to CMT in continuous flow systems an acclimation period of 14 weeks was necessary before efficient degradation occurred. Once acclimated to CMT the biomass could be starved in regard to this substrate for at least 1.6 times the sludge age and still retain capacity to degrade the material upon re-introduction. Activated carbon was not found to be effective for CMT removal at a pH value of 7. (EIS-Katz)

W79-03994

### 5E. Ultimate Disposal Of Wastes

#### UTILIZING SOLID WASTES FOR BUILDING MATERIALS,

Municipal Environmental Research Lab., Cincinnati, OH.

R. E. Landreth.

News of Environmental Research in Cincinnati, January 25, 1977. 4 p, 2 fig, 2 ref.

Descriptors: \*Ultimate disposal, \*Waste treatment, \*Recycling, \*Construction materials, Wastes, Phenols, Fly ash, Industrial wastes, Plastics, Wood wastes, Solid wastes.

Research on the application of solid waste materials which could be integrated into standard composite products for the building industry is reported. Successful utilization of waste materials for this purpose includes: (1) an assessment of the type, location and volume; (2) development of the material into a composite product; (3) development of the product into standard building components; (4) economic evaluation; and (5) a utility demonstration as full scale units. Laboratory studies indicated that furfural, inorganics, and phenols were the best materials to be used as binding agents or matrices. Materials useful as reinforcement were also useful as filler materials; wood bark, waste plastic rice hulls, peanut shells and fly ash were selected for composite development. Various combinations of waste materials and methods produced a product comparable to commercially available particle board, a potential replacement for sheet rock, fire doors, and fire rated partition walls. The inorganic composites would not burn, and produced no smoke, which eliminates some fire hazards. It is concluded that building products developed from waste materials are structurally sound, aesthetically pleasing and can be produced at 50 to 70% of the costs of standard building materials. (Davison-IPA)

W79-0370

#### BIOGAS RECOVERY FROM SOLID WASTES,

Municipal Environmental Research Lab., Cincinnati, OH.

C. A. Clemons.

News of Environmental Research in Cincinnati, September 15, 1976. 4 p, 1 fig, 10 ref.

Descriptors: \*Waste disposal, \*Biogasification, \*Ultimate disposal, \*Anaerobic digestion, Sludge digestion, Methane, Animal wastes, Landfills, Farm wastes, Municipal wastes, Sewage sludge, Sludge treatment, Economic feasibility, Solid wastes.

A summary of research and current activities relating to biogasification of solid wastes is presented. Anaerobic digestion of cattle wastes has been studied as to feed quality of the sludge and economic feasibility by the Northern Regional Research Center of the Department of Agriculture in Illinois. Further study involving the building of a digester in Nebraska is expected to establish the nutritional value of these residues. A number of universities are involved in research on animal wastes from cattle, swine, horses and poultry, and have built digesters to process these wastes. Research is being sponsored by the Energy Research and Development Administration on biogasifica-

tion at Stanford, Cornell, the University of California at Berkeley, and the University of Illinois. Companies financing the construction of large-scale digesters to produce pipe-line quality methane include: ERA Incorporated of Lubbock, Texas, and Calorific Recovery Anaerobic Process Incorporated of Oklahoma City. Operational parameters of the process as applied to urban trash have been defined and a computer analysis of the economics of the process has been prepared. Biogas produced from sewage sludge is of poor quality and low quantity because the toxic materials present in human sewage sludge destroy or inhibit anaerobic digestion. Land fills are a comparatively small source of biogas. Methane has been recovered from the Los Angeles County, Palos Verdes landfill by Reserve Synthetic Fuels which has plans to develop other methane recovery sites in California, Arizona, Illinois, New Jersey, New York, and Pennsylvania. (Davison-IPA)

W79-03571

#### PHARMACEUTICAL INDUSTRY: HAZARDOUS WASTE GENERATION, TREATMENT, AND DISPOSAL.

Environmental Protection Agency, Washington, DC. Office of Solid Waste Management Programs. For primary bibliographic entry see Field 5D.

W79-03579

SURVEY OF BENTHIC CORAL REEF ECOSYSTEMS, FISH POPULATIONS, AND MICROMOLLUSKS IN THE VICINITY OF THE WAI'ANAE SEWAGE OCEAN OUTFALL, O'AHU, HAWAII — SUMMER 1975, Hawaii Univ., Honolulu. Water Resources Center. S. A. Reed, E. Kay, and R. Russo. Technical Report No. 104, May 1977. 34 p, 10 fig, 4 tab, 14 ref, 2 append.

Descriptors: \*Benthic ecosystems, Fish populations, \*Coral reefs, \*Hawaii, Outfalls, Waste disposal, Sewage disposal, \*Mollusks, \*Diversity indices, \*Similarity indices, \*Seawage ocean outfall, Marine survey.

A marine survey was conducted in the vicinity of the present and proposed Wai'anae sewage ocean outfall site on the southwest coast of O'ahu, Hawaii. The survey at depths of 6 to 30 m (20-100 ft) characterized quantitatively the coral reef community, the reef fish population, and micro-molluscan assemblages. Diversity indices were calculated for substrate, fish, and micromollusks. Similarity indices were computed and a dendrogram was generated for all stations. The stations could be clustered into three distinct regions: (1) a deep-water region (18-30 m depth) with smooth hard algae-covered limestone substrate and sand, low fish abundance and diversity, low micromollusk diversity with high abundance of dialids, and low abundance of archeogastropods and rissoids; (2) a shallow-water region (6-18 m depth) with comparatively high coral cover, high fish abundance and diversity, high micromollusk diversity with low abundance of dialids and high abundance of rissoids and archeogastropods; and (3) the region along the harbor channel at POHA'I Bay where coral cover, fish abundance and diversity, and micromolluscan species abundance were distinctly different from those of other stations, indicating a probable influence by the boat harbor and channel on the benthic community. The sewage effluent has not adversely influenced coral growth in the vicinity of the outfall diffuser, although increased nutrients may account for high abundance of filamentous algae at this station. (W79-03591)

THE EFFECT OF WASTEWATER TREATMENT ON METHANOGENESIS IN A MARINE OUTFALL, California Univ., Los Angeles. For primary bibliographic entry see Field 5C.

W79-03636

THE EFFECTS OF SPARY IRRIGATION ON A MIXED FOREST ECOSYSTEM, New Hampshire Univ., Durham. Dept. of Botany. For primary bibliographic entry see Field 5C. W79-03679

EFFECT OF SOIL MOISTURE CONTENT UPON ADSORPTION AND MOVEMENT OF PHOSPHORUS FROM LEACHATES OF DOMESTIC WASTE DISPOSAL SYSTEMS, Maine Univ. at Orono.

For primary bibliographic entry see Field 5B.

W79-03683

MEASUREMENT OF THE ENGINEERING PROPERTIES OF MUNICIPAL INCINERATOR RESIDUES AND CONSIDERATION OF LEACHATE CHARACTERISTICS, Connecticut Univ., Storrs.

For primary bibliographic entry see Field 5B.

W79-03685

EFFECTS OF SPARY IRRIGATION OF MUNICIPAL WASTEWATER ON THE PHYSICAL PROPERTIES OF THE SOIL, Pennsylvania State Univ., University Park. School of Forest Resources.

For primary bibliographic entry see Field 5C.

W79-03766

METHOD OF DISPOSING OF A FERROUS-ION CONTAINING ACIDIC AQUEOUS WASTE FOR FORMING POLYCRYSTALLINE IRON COMPOUND PARTICLES, Nippon Electric Co. Ltd., Tokyo. (Assignee)

For primary bibliographic entry see Field 5D.

W79-03790

ARRANGEMENT FOR DISPOSING OF FLUID FLOATING MATTER, Mitsui-Osaka Maritime Construction Co. Ltd. (Japan). (Assignee). For primary bibliographic entry see Field 5G.

W79-03793

COMBINED FILTER AND INCINERATOR, Thiokol Corp., Newtown, PA. (Assignee). For primary bibliographic entry see Field 5D.

W79-03797

THE BEHAVIOR OF NUTRIENT ELEMENTS ADDED TO A FOREST SOIL WITH SEWAGE SLUDGE, Washington Univ., Seattle. Center of Ecosystem Studies.

For primary bibliographic entry see Field 5B.

W79-03805

IMPACT OF NEARSHORE DEVELOPMENT ON OPEN COASTAL RESOURCES, Southern California Coastal Water Research Project, El Segundo, CA. For primary bibliographic entry see Field 5C.

W79-03829

THE ALGAL GROWTH POTENTIAL OF AN INLAND SALINE AND EUTROPHIC LAKE, North Dakota Univ., Grand Forks. Dept. of Biology. For primary bibliographic entry see Field 5C.

W79-03891

CHANGES IN SUCCESSION RATE IN A NATURAL PHYTOPLANKTON COMMUNITY FOLLOWING NUTRIENT ENRICHMENT, Stockholm Univ. (Sweden). Inst. of Botany. For primary bibliographic entry see Field 5C.

W79-03894

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5E—Ultimate Disposal Of Wastes

PCBS: THEIR ENVIRONMENTAL SIGNIFICANCE AND DISTRIBUTION IN RHODE ISLAND, Rhode Island Univ., Narragansett, Coastal Resources Center. For primary bibliographic entry see Field 5B. W79-03964

POLLUTION CONTROL GUIDELINES FOR COAL REFUSE PILES AND SLURRY PONDS. Wahler (W. A.) and Associates, Palo Alto, CA. For primary bibliographic entry see Field 5G. W79-03968

PRELIMINARY ENVIRONMENTAL ASSESSMENT OF BIOMASS CONVERSION TO SYNTHETIC FUELS, Battelle Columbus Labs., OH. For primary bibliographic entry see Field 5G. W79-03973

INVESTIGATION OF LANDFILL LEACHATE POLLUTANT ATTENUATION BY SOILS, Arizona Univ., Tucson, Dept. of Soils, Water and Engineering. For primary bibliographic entry see Field 5B. W79-03983

A CASE STUDY OF HAZARDOUS WASTES IN CLASS I LANDFILLS, Southern California Univ., Los Angeles, Environmental Engineering Program. For primary bibliographic entry see Field 5B. W79-03984

LINERS FOR SANITARY LANDFILLS AND CHEMICAL AND HAZARDOUS WASTE DISPOSAL SITES, Ebon Research Systems, Silver Spring, MD. For primary bibliographic entry see Field 5G. W79-03985

STATE-OF-THE-ART REPORT: PESTICIDE DISPOSAL RESEARCH, Midwestern Research Inst., Kansas City, MO. R. R. Wilkinson, G. L. Kelso, and F. C. Hopkins. Available from the National Technical Information Service, Springfield, VA 22161 as PB-284 716. Price codes: A11 in paper copy, A01 in microfiche. Report No. EPA-600/2-78-183, September 1978. 246 p, 32 fig, 29 tab, 182 ref, 3 append. 68-03-2527.

Descriptors: \*Reviews, \*Pesticide removal, \*Waste treatment, \*Waste disposal, Incineration, Pesticide treatment, Degradation, Chemical wastes, Landfills, Anaerobic digestion, Ultimate disposal, Chemical reactions, Cost analysis, Environmental effects, Reviews.

A review of published and unpublished information on recent and continuing research and development on waste or excess pesticide disposal and conversion methods is presented. The methods were categorized according to four approaches: high temperature incineration; physical/chemical treatment; biological methods; and land disposal. Potential economic costs and environmental impacts, problems of field disposal of finished pesticide formulations, and present and potential future 'problem' pesticides are also examined. It was concluded that for all methods examined, that more study would be required because potential environmental and economic impacts had not been adequately or completely defined. Of the 55 problematic pesticides, considered as potential or future waste problems, 23 have been researched for potential disposal methods which can be made environmentally acceptable. (Davison-IPA) W79-03986

BIODEGRADATION STUDIES OF CARBOXYMETHYL TARTRONATE, Municipal Environmental Research Lab., Cincinnati, OH. Wastewater Research Div. For primary bibliographic entry see Field 5D.

W79-03994

### 5F. Water Treatment and Quality Alteration

#### IMPROVED WATER SOFTENING PROCESS, J. D. Sheppard, and D. G. Thomas.

Available from the National Technical Information Service, Springfield, VA 22161 as PAT APPL-533 048, Price codes: A02 in paper copy, A01 in microfiche. Patent Application, Serial No. 533, 048, February 25, 1975. 9 p, 1 fig, 1 tab.

Descriptors: \*Water treatment, \*Water softening, Demineralization, Filtration, Membrane processes, Quality control, Separation techniques, Hardness(Water), Calcium compounds, Magnesium compounds, Lime-soda process.

An innovative process of softening water hardness caused by  $\text{CaCO}_3$  and  $\text{Mg(OH)}_2$  is discussed. A modified form of the lime-soda process is employed coupled with cross-flow filtration. A principal feed source of this process is derived from the lime-soda process whereby large-scale hardness is removed through the addition of slaked lime in large tanks; the precipitated hardness allowed to settle. The resulting slurry serves as feed for the cross-flow filtration. This involves pumping feed through a porous pipe on which is deposited a thin permeable layer of finer porosity than the pipe. The feed water passes across the deposited layer and across the tube wall, and is collected as a filtered product. Feed hardness as high as 5000 ppm has been processed by this method. (Davison-IPA) W79-03574

#### SIMPLE, EFFECTIVE METHOD FOR PURIFYING THE AS-1 CYANOPHAGE, C. E. Rice, J. E. Garton, and M. L. Magnuson.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 750, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Inst., Oklahoma State Univ. Research Project Tech Completion Rept 1978. 17 p, 2 fig, 4 tab, 2 ref. OWRT-A-066-OKLA(1).

Descriptors: \*Viruses, \*Water purification, \*Microbiology, Laboratory tests, Dialysis, Centrifugation, Bentonite, Aeration, Evaporation, Microorganisms, Water pollution sources, Toxicity, Infection.

M. B. Barkley, and P. R. Desjardins.

Applied and Environmental Microbiology, Vol. 33, No. 4, p 971-974, April 1977. 3 fig, 5 ref. OWRT B-176-CAL(2).

Descriptors: \*Viruses, \*Water purification, \*Microbiology, Laboratory tests, Dialysis, Centrifugation, Bentonite, Aeration, Evaporation, Microorganisms, Water pollution sources, Toxicity, Infection.

A new method for purifying the AS-1 cyanophage virus involves treating virus-induced culture lysates with unfractionated bentonite, dialysis against 0.01M tris (hydroxymethyl) aminomethane-hydrochloride buffer, rotary evaporation concentration, and centrifuging through linear sucrose gradient columns. Small amounts (100 ml) of lysate are required to obtain relatively high yields of highly infectious virus. Bentonite clarification along with density gradient centrifugation could be used for the purification of other cyanophages. (Davison-IPA) W79-03583

#### FLUORIDE REMOVAL AND RELEASE BY ALUMINUM SULFATE FLOC, Auburn Univ., AL. Dept. of Civil Engineering.

For primary bibliographic entry see Field 5G. W79-03677

#### ECONOMIC ANALYSIS OF CHLOROFORM REMOVAL FROM DRINKING WATER, Maryland Univ., College Park, Bureau of Business and Economic Research.

J. H. Cumberland, and K. Choi.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 574, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Center, University of Maryland, Technical Report No. 49, 1978. 52 p, 7 fig, 11 tab, 46 ref, append. OWRT A-032-MD(1), 14-34-0001-8022.

Descriptors: Water treatment, Potable water, \*Chloroform, Water quality, Damage function, \*Treatment costs, Cost-benefit analysis, \*Economic analysis, Cost analysis, \*Alternative costs.

Recent research has demonstrated that organic contaminants of potential health significance are ubiquitous in America's drinking water. Among these many compounds, chloroform is rapidly becoming an object of state and federal regulatory interest because several scientific studies have found a link between cancer death rates and concentration levels of chloroform in drinking water. The purpose of this study is to provide an assessment of the scientific and technical information needed to conduct a benefit-cost analysis of removing chloroform from drinking water. The analysis focuses on the derivation of a benefit function from the removal of chloroform in finished drinking water, and then compares the derived benefits with costs associated with control methods. This study also provides a systematic framework for coordinating diverse data and a method of analyzing the way that different assumptions would affect the alternatives likely to be considered by the regulatory agency. W79-03680

#### EVALUATION OF A PROTOTYPE AUTOMATED POND WATER TREATMENT UNIT, Oklahoma State Univ., Stillwater, Dept. of Agricultural Engineering.

C. E. Rice, J. E. Garton, and M. L. Magnuson. Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 750, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Research Inst., Oklahoma State Univ. Research Project Tech Completion Rept 1978. 17 p, 2 fig, 4 tab, 2 ref. OWRT-A-066-OKLA(1).

Descriptors: \*Water treatment, \*Ponds, \*Filtration, \*Filters, \*Turbidity, Alum treatment, Performance, Maintenance, Operations, Rural water supply, Upflow filter.

Two automatic pond water filtration units were tested with performance evaluated by analysis of both raw and treated water samples. A large filter, three feet in diameter, was tested and provided water at just over two gpm per square foot. The small filter, with an area of one square foot, was tested at various flow rates, run lengths, and total operating times. Both units were upflow filters with flocculation taking place below the filter media. The units effectively reduced turbidity as indicated by analysis of raw and purified water. High turbidity waters could not be effectively treated, and high flow rates gave unsatisfactory results. The filters had to be operated at or close to the design flow of one gpm per square foot. Correct alum dosage were important to insure a functional filter system. Maintenance of the system required periodic refilling of chemical solution tanks, backwashing of the filter, and replacement of filter media. These operations could easily be done in conjunction with a time clock regulation of the system. W79-03764

#### COLLOID FREE PRECIPITATION OF HEAVY METAL SULFIDES, Sachs-Systemtechnik G.m.b.H., Schweinfurt (Germany, F. R.). (Assignee).

P. Paschakarnis, B. Hengst, and R. Wychanek. U.S. Patent No. 4,119,520, 9 p, 4 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 97, no. 2 p 666, October 10, 1978.

Descriptors: \*Patents, \*Water purification, Water quality control, \*Electrolysis, Filtration, \*Oxidation, Electrodes, \*Anodic oxidation.

A water system capable of purifying raw water by anodic oxidation is described. The system includes

an electrode to be pured cell and cell is fast to a cont cell in a supplies the cell. signal, su the oper power su particulate in the cell the water OEIS) W79-037

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## Water Quality Control—Group 5G

an electrolytic cell adapted to hold a body of water to be purified. Two electrodes are mounted in the cell and electrically insulated from each other. The cell is fastened to a pump, to a power supply, and to a control device. The pump supplies the water to the cell and discharges purified water from the cell in a predetermined path. The power supply supplies electrolytic current to the electrodes in the cell. The control device generates a sensible signal, such as an optical signal, which indicates the operating condition of the pump and of the power supply. Additionally a filter removing particulate impurities from the water discharged by the cell may include a filter element arranged in the water path upstream from the cell. (Sinha-OEIS)  
W79-03789

## METHOD FOR SLIME CONTROL,

For primary bibliographic entry see Field 5G.  
W79-03791

## MANUAL FOR THE INTERIM CERTIFICATION OF LABORATORIES INVOLVED IN ANALYZING PUBLIC DRINKING WATER SUPPLIES — CRITERIA AND PROCEDURES,

Environmental Protection Agency, Washington, DC.

For primary bibliographic entry see Field 5A.  
W79-03979

## THE MULTIELEMENTAL ANALYSIS OF DRINKING WATER USING PROTON-INDUCED X-RAY EMISSION (PIXE),

Purdue Research Foundation, Lafayette, IN.

For primary bibliographic entry see Field 5A.  
W79-03981

## HUMAN POPULATION EXPOSURES TO MIREX AND KEPONE,

Stanford Research Inst., Menlo Park, CA. Center for Resource and Environmental Systems Studies. For primary bibliographic entry see Field 5C.  
W79-04000

## 5G. Water Quality Control

## THE PRESENT SITUATION AND THE RATE OF SELF-PURIFICATION OF THE UPPER REACHES OF THE SUKHONA RIVER,

Akademii Nauk SSSR, Leningrad. Inst. of Ozerovedeniya.

D. N. Aleksandrova and T. D. Slepukhina. Hydrobiological Journal, Vol. 13, (2), 1977, p. 76-81. 3 tab, 2 fig, 8 ref. (translated from Russian).

Descriptors: \*Water pollution effects, \*Biodegradation, \*Biological communities, Biology, Sediments, Self-purification, Benthos, Oligochaetes, Water quality, Hydrology, \*Sukhona River, Phytoplankton, Zooplankton, Bacteria, Biomass, Biological diversity, USSR.

Studies on a 42 km long zone of the Sukhona river were made, testing for 26 hydrological, hydrochemical, and biological factors. Changes in biological processes and factors along the river were discovered. The pollution rates of self-purification of the water and bottom soils, based on the relative numbers of Oligochaeta, the index of species diversity of the macrobenthos and the ratio between the total numbers of bacteria and the numbers of saprophytes growing on beef-extract agar (and also on the BOD<sub>5</sub>) are estimated. (EIS-Deal)  
W79-03505

## UREA FERTILIZATION OF NATURAL FOREST: EFFECTS ON WATER QUALITY,

Laurentian Forest Research Centre, Quebec (Ontario).

For primary bibliographic entry see Field 5C.  
W79-03507

## ALLOCATIONAL INEFFICIENCY OF BENEFIT/COST APPLIED TO WATER AND SEWERAGE SUPPLY: INTERACTIONS BETWEEN TIME-SERIES AND CROSS-SECTIONAL MODELS,

Pennsylvania State Univ., University Park. Dept. of Economics.

For primary bibliographic entry see Field 6B.  
W79-03520

## URBAN RUNOFF CONTROL MASTER PLANNING,

American Society of Civil Engineers, Marblehead, MA. Urban Water Resources Research Program. For primary bibliographic entry see Field 6B.  
W79-03532

## CALIFORNIA CHANGES ITS ENVIRONMENTAL QUALITY ACT,

California Resources Agency, Sacramento. N. E. Hill.

Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 104, No WR 1, p 265-271, November 1978. 1 appen.

Descriptors: \*Environmental engineering, \*Legislation, \*Government agencies, \*California, \*Urban planning, Natural resources, Conservation, Urban development.

Studies showed that California EIR's had become too large and costly. The documents did not help part-time city councilmen respond to problems. In some cases, the documents were prepared and then ignored. Despite these problems, the studies found that review of environmental impacts was valuable and should be improved. Following these studies, the California Legislature amended the law in 1976 to shorten EIR's, to focus the reports on environmental problems, and to require agencies to respond to those problems. A summary, a list of references, and a table of contents or index were required to help readers find critical information. Through a requirement for findings, public agencies are now required to solve environmental problems or to explain why the problems could not be solved. These changes provide more integration of environmental, economic and social concerns in the environmental analysis process. (Bell-Cornell)  
W79-03535

## DELAWARE RIVER BASIN WATER RESOURCES MANAGEMENT,

Delaware River Basin Commission, Trenton, NJ. For primary bibliographic entry see Field 6B.  
W79-03538

## WET/DRY COOLING SYSTEMS FOR FOSSIL-FUELED POWER PLANTS: WATER CONSERVATION AND PLUME ABATEMENT,

United Engineers and Constructors, Inc., Philadelphia, PA.

M. C. Hu, and G. A. Englesson. Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 625. Price codes: A13 in paper copy, A01 in microfiche. Report EPA-600/7-77-137, November 1977, 275 p, 38 fig, 38 tab, 14 ref, 16 append. 68-03-2202.

Descriptors: Environmental effects, \*Cooling towers, \*Powerplants, Cost analysis, Design, Design criteria, Fog, \*Water conservation, Pollution.

This report presents the results of a design cost study for wet/dry cooling tower systems used in conjunction with 1000 MWe coal-fired power plants to reject waste heat dry tower systems can be designed to provide significant economic advantages over dry cooling while closely matching the dry tower's ability to conserve water. This economic advantage can be maintained by wet/dry systems which save as much as 98% of the makeup water required by wet towers. The advantage of wet cooling over wet/dry cooling may be small in areas with remote water supply sources. In areas where water costs are excessive, wet/dry cooling

can reach economic parity with wet cooling. Ground fogging from low profile wet cooling towers can be reduced by design changes which increase the number of cells without significantly increasing the total evaluated cost of the wet cooling tower. In cases of restrictive site conditions or fogging limitations, wet/dry cooling towers may be used effectively at costs approximating those of enlarged wet towers. (Chilton-ORNL)  
W79-03547

## DESIGN AND ANALYSIS OF AQUATIC MONITORING PROGRAMS AT NUCLEAR POWER PLANTS,

Battelle Pacific Northwest Labs., Richland, WA. D. H. McKenzie, L. D. Kannberg, K. L. Gore, E. M. Arnold, and D. G. Watson.

Available from the National Technical Information Service, Springfield, VA 22161 as PNL-2423, Price codes: A07 in paper copy, A01 in microfiche. PNL-2423, NRC-1; November 1977. 129 p, 42 fig, 17 tab, 36 ref, 1 append. DOE EY-76-C-06-1830.

Descriptors: Environmental effects, \*Powerplants, \*Monitoring, Aquatic life, Design, Sites, Control, \*Aquatic environments.

This report addresses some of the problems of designing, conducting, and analyzing aquatic environmental monitoring programs for impact assessment. The concept of control and treatment station pairs, based on the hypothesis that the relationship between the two stations forming the pair can be estimated from the preoperational period and that this relationship holds during the operational period, is the fundamental basis for the experimental method proposed. The major problem in establishing station pairs identified as being the location of the control station which must remain unaffected by the operation of the power plant. The control station must also be near enough to the power plant that the biological communities will respond to natural environmental changes consistently in the same manner. The collection of balanced data sets is also identified as an important concept in the design of aquatic monitoring programs. The report proposes guidelines for some of the problems encountered during the statistical analysis of data. (Chilton-ORNL)  
W79-03566

## CHEMICAL ADDITIVES FOR IMPROVEMENT OF OIL SPILL CONTROL,

Rensselaer Polytechnic Inst., Troy, NY.

W. H. Bauer, D. N. Borton, J. J. Bulloff, and S. Ross.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A009 019. Price codes: A09 in paper copy, A01 in microfiche. Final Report No. CG-D-83-75, August 1974. 133 p, 9 fig, 7 tab, 717 ref, 1 append. DOT-CG-33755-A.

Descriptors: \*Oil spills, \*Waste water treatments, \*Chemcontrol, \*Bibliographies. Water pollution sources, Oil pollution, Laboratory tests, Data collections, Entrainment, Polyethylene, Viscosity, Waste treatment, Coagulation, Waste treatment, Coagulation, Waste water treatment, Water pollution control, Water pollution abatement, Water pollution treatment.

Abstract literature and Coast Guard information were used to develop a base of information for this state-of-the-art report. From this data, apparatus and methods were developed to study the effects of chemical additives for improving oil spill control. Sixteen types of oil and two highly purified hydrocarbon reference oils were tested with various chemical additives. The additives exhibiting the most effectiveness in improving oil control performance were then studied over a range of concentrations in the chosen test oil and at a selected concentration in other oils. Oil soluble polyethylenes and ethylene-propylene copolymers were found to be the most effective. The oil exhibited a wide range of viscosities and interfacial tensions, but they all showed initial droplet formation and entrainment at oil-water co-current velocities of about 0.5 knots. An extensive bibliography is provided. (Davison-IPA)

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

W79-03575

#### DEMONSTRATION OF INTERIM TECHNIQUES OF POLLUTED BEACHWATER, Cleveland Dept. of Public Works, OH.

J. F. Weber.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 192. Price codes: A09 in paper copy, A01 in microfiche. Report No. EPA-600/2-76-228, September 1976. 181 p, 64 fig, 48 tab, 4 ref, 9 append. 11020 EZW.

Descriptors: \*Beaches, \*Water pollution, \*Lake Erie, \*Water pollution abatement, Waste water treatment, Barriers, Disinfection, Chlorination, Water quality control, Public health, Organic wastes, Sewage, Municipal wastes, Outfall sewers, Swimming.

The contaminated beaches on Lake Erie bordering Cleveland were made safe for swimming through interim techniques designed to keep the beaches safe until long range goals could be implemented. The beach areas became contaminated from combined sewer overflows, and floating debris. Physical barriers were designed to separate the lake water from the beach water, to keep out the sewer debris and to retard the diffusion of the disinfectant into the deep water. Floating debris was removed with nets and larger debris such as logs were removed with a bulldozer and a dump truck. Sodium hypochlorite diluted with fresh water provided a positive displacement of the water within the barriers and reduced the infiltration of the contaminated lake water into the enclosure. Streams and storm overflows with outfalls near the swimming areas were chlorinated to reduce bacterial levels. The three methods of reducing lake-front contamination were: (1) the addition of flow increasing polyelectrolytes into an interceptor sewer to reduce combined sewer overflow; (2) flushing lateral sewers of residential areas during dry weather, reducing the 'first slug' effect of settled solids during a storm; and (3) cleaning debris from rivers and streams before it reached the lake. Bacterial aftergrowth was studied to develop method to optimize chlorination as a disinfectant. (Davison-IPA)

W79-03576

#### ISSUES IN WASTE WATER TREATMENT FACILITY LOCATION,

Rutgers - The State Univ., New Brunswick, NJ. Dept. of Urban Planning and Policy Development. M. R. Greenberg.

Growth and Change, Vol. 3, No. 1, p. 38-43, January, 1972. 1 tab. (OWRT-C-1629(No. 3147)(7).

Descriptors: Water resources, \*Urban land use, \*Sewerage, \*Waste water treatment, Planning, Water supply, Environmental effects, Water quality, Locating, Regions, \*Treatment facilities, Facility location, Regionalization.

The principle usually followed in waste water treatment plant location is to establish regional control with a minimum number of plants, frequently one at the lowest point in each drainage system. State and county government generally support this concept. The Federal Water Quality Act recommends development of comprehensive river basin studies, encouragement of interstate compacts, and requirement of conformance with basin studies for federal grants, with a 10% incremental grant if the plant is part of a metropolitan regional plan. The federal program goal is a drastic reduction of pollution loads of waste water discharges by 1975. Effectiveness of regionalization can be evaluated from the perspectives of planning, economics, and environment. The regional plant has the potential of halting the sparse settlement of undeveloped areas by higher income populations because its greater capacity will permit development at densities greater than the small local plant. Development can be expected to follow the location of large trunk lines. Impact of regional plants on cities is debatable. Industries required to upgrade waste water treatment may prefer to close or relocate, with resultant loss of employment for monitory groups, rather than pay

higher user charges for the regional system. Significant economies of scale design, construction, and operation favor the regional treatment plant. Environmentally, a regional system would enhance public water supplies and recreational activities. Streams would not receive effluents in vast stretches. Groundwater supplies would not be polluted by malfunctioning septic tank systems. However, costly monitor and storage systems must be provided in treatment plants to prevent disastrous discharge of toxic wastes. (Edwards - North Carolina)

W79-03594

#### ANALYSIS OF DIFFERENT TYPES OF DRY WET COOLING TOWERS,

Iowa Univ., Iowa City. Inst. of Hydraulic Research.

For primary bibliographic entry see Field 8C. W79-03661

#### OPTIMUM COMBINATIONS OF COOLING ALTERNATIVES FOR STEAM-ELECTRIC POWER PLANTS,

Iowa Univ., Iowa City. Inst. of Hydraulic Research.

For primary bibliographic entry see Field 8C. W79-03662

#### PUBLIC PARTICIPATION IN 208 WATER QUALITY PLANNING: A CASE STUDY OF TRIANGLE J COUNCIL OF GOVERNMENT, NORTH CAROLINA,

North Carolina Univ. at Chapel Hill. Dept. of City and Regional Planning; and North Carolina Univ. at Chapel Hill. Center for Urban and Regional Studies.

S. Herzberg.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 587. Price codes: A04 in paper copy, A01 in microfiche. Report, April 1978, 66p, 9 ref, 3 append. OWRT A-096-NC(1), 14-34-0001-8035.

Descriptors: \*Public participation, \*Advisory groups, \*Citizen participants, Decision-making, \*State governments, \*Local governments, \*North Carolina.

The evaluation of methods of public participation in water quality planning is being undertaken by the Public Participation Study Group of the Department of City and Regional Planning, UNC-CH. A completed 208 planning process was studied to identify issues and problems of public participation in water quality planning in North Carolina context. The overall research includes description and analysis of the various participation activities undertaken during preparation of the state-wide plan, from state level advisory groups to local involvement in small area plans. The primary aim is to compare the effectiveness of different methods of public participation during the stages of the planning process. (Kiger-North Carolina)

W79-03666

#### ADSORPTION AND DESORPTION IN MINE DRAINAGES,

Colorado School of Mines, Golden.

For primary bibliographic entry see Field 5B. W79-03673

#### WATER RESOURCE STANDARDS FOR SECOND HOME AND RECREATIONAL LAND DEVELOPMENT,

North Carolina Univ. at Chapel Hill. Center for Urban and Regional Studies.

L. F. West.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 681. Price codes: A03 in paper copy, A01 in microfiche. Research Memorandum April 1977, 42 p, 1 fig, 22 ref. OWRT A-092-NC(1), 14-34-0001-8035.

Descriptors: \*Recreation, \*Land development, \*Vacation sites, Water supply, Sewage disposal, \*North Carolina.

W79-03684

In recent years the North Carolina mountains have faced a rapid influx of second home and recreational land development. Unfortunately, increased land development in this region is resulting in the gradual degradation of once pristine waters. At the same time there is increased demand for high quality water for human consumption. While some water resources problems would have resulted from any kind of development, many of them can be traced to particular development and construction practices which have been recognized by experts as particularly destructive to the environment. Numerous standards for land development focusing on minimizing the adverse effects on the area's water resources have been identified. The purpose of these criteria and standards is to facilitate the development of an evaluation form which can be used to analyze specific second home projects regarding their impact on the area's water resources. Standards and criteria were selected largely on the basis of their susceptibility to field measurement. As such, very few engineering or detailed design criteria were included. The dominant emphasis was on site criteria, such as lot size standards and the appropriate spacing of different facilities, which directly relate to water quality. These land development standards have been divided into six major functional categories: (1) water supply; (2) sewage disposal; (3) slopes, stormwater runoff and sedimentation; (4) floodplains; (5) open space and recreation; and (6) golf course development. While the inter-relationship between these six areas is quite significant, it is still possible to identify specific standards and criteria relating to each functional area. (Kiger-North Carolina)

W79-03675

#### ECONOMIC ANALYSIS OF CHLOROFORM REMOVAL FROM DRINKING WATER,

Maryland Univ., College Park. Bureau of Business and Economic Research.

For primary bibliographic entry see Field 5F. W79-03680

#### INSECT PEST PROBLEMS ASSOCIATED WITH WASTEWATER OXIDATION LAKES IN MICHIGAN,

Michigan State Univ., East Lansing. Dept. of Entomology.

R. W. Merritt.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 610. Price codes: A03 in paper copy, A01 in microfiche. Institute of Water Research, Michigan State University Project Completion Report, December, 1978, 46 p, 8 fig, 4 tab, 32 ref. OWRT A-085-MICH(1), 14-31-0001-5022.

Descriptors: \*Waste water pollution, \*Midges, \*Oxidation lakes, \*Insects, Sewage, Diptera, \*Oxidation lagoons, \*Environmental factors, \*Distribution, Abundance, \*Michigan, Larvae.

The distribution and abundance of larval Chironomidae were investigated in the first and last lakes of a 4-lake sewage oxidation system. Chironomid species composition and adult seasonal occurrence were examined and the potential of certain species to become pests of man was evaluated. A stratified random sampling program was employed to quantitatively sample larvae in Lakes 1 and 4. Each lake was stratified by depth, distance from the influent site, and wind. Samples were taken during the summer and early fall of 1976 and during late spring and early summer 1977. Chironomidae was the dominant subfamily in both lakes initially: the Orthocladiinae gradually becoming dominant in Lake 4 by early summer 1977. The patterns of larval distribution and abundance in Lakes 1 and 4 indicate that the Chironomidae actively responded to differences in oxygen and nutrient availability in the sediments by migrating to areas offering favorable conditions. Oxygen appeared to be the limiting factor in Lake 1, nitrogen and phosphorus in Lake 4.

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## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Water Quality Control—Group 5G

**METHODOLOGIES OF EXAMINING POLLUTION FROM URBAN RUNOFF,**  
Rutgers - The State Univ., New Brunswick, NJ.  
Dept. of Civil and Environmental Engineering.  
For primary bibliographic entry see Field 5B.  
W79-03689

**CONTRIBUTED PAPERS ON COASTAL ECOLOGICAL CHARACTERIZATION STUDIES,**  
FOURTH BIENNIAL INTERNATIONAL ESTUARINE RESEARCH FEDERATION CONFERENCE, OCTOBER 1977.

Fish and Wildlife Service, Washington, DC. Office of Biological Services.  
For primary bibliographic entry see Field 2L.  
W79-03697

**ENVIRONMENTALIZING AGRICULTURAL PRODUCTION CONTROL POLICIES,**

Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Economics.  
W. D. Seitz and R. G. F. Spitzke.  
Journal of Soil and Water Conservation, Vol. 28, No. 2, p. 61-64, 1 fig, 10 ref. March-April 1973. OWRT A-061-ILL(3), 14-31-0001-3813.

**Descriptors:** Agriculture, \*Environmental control, \*Economics, \*Land management, Soil conservation, Agriculture policy, Policy alternatives, Watershed linear programming.

Ongoing public agricultural policies, which are the results of years of compromise among parties with competing interests reveal little sensitivity to their effects on environmental quality. Public price, income and production control policies in agriculture relate to problems of soil erosion and sedimentation. Current critical review of the 1970 Agricultural Act suggests that land retirement programs for the future are likely to be changed. Various public policy proposals are examined which alter the current set-aside program as a means of increasing agriculture's performance from environmental quality perspective. Possible program changes include (1) alteration in requirements for program participation to include soil conservation practices, (2) intrastate payment variation reduction, (3) interstate payment variation reduction, and (4) use of incentives for improved management practices on all farms. The first three proposals involve modification of the price, income, production control program. These proposals would shift production to areas that are less prone to erosion and extend the use of soil conservation practices on participating farms. The final proposal would tend to improve management practices of all farm operations so as to reduce the level of sedimentation. W79-03767

**ENVIRONMENTAL QUALITY, THE MARKET, AND PUBLIC FINANCE,**  
Clemson Univ., S. C. Water Resources Research Inst.

For primary bibliographic entry see Field 6G.  
W79-03768

**FEDERAL COMPLIANCE WITH STATE POLLUTION CONTROL REQUIREMENTS - CALIFORNIA V. ENVIRONMENTAL PROTECTION AGENCY, 511 F. 2D 963 (9TH CIR. 1975),**  
Wyoming Univ., Laramie. Coll. of Law.

For primary bibliographic entry see Field 6E.  
W79-03770

**COLLOID FREE PRECIPITATION OF HEAVY METAL SULFIDES,**

R. M. Schlauch.  
U.S. Patent No. 4,102,784, 7 p, 2 tab, 2 ref; Official Gazette of the United States Patent Office, Vol. 972, No. 4, p 1614, July 25, 1978.

**Descriptors:** \*Patents, \*Water pollution treatment, \*Water quality control, Water purification, Heavy metals, Chemical precipitation, Separation techniques, Sulfides, Ions.

In a method of precipitating heavy metal pollutant ions from an aqueous solution by adding a metal sulfide having a higher equilibrium sulfide ion concentration than the sulfide of the heavy metal pollutant, the metal sulfide is added in the form of a slurry. The slurry is prepared in a specific manner to cause large particle size of the precipitate. The object of the invention is to provide a process of removing heavy metal pollutants as a substantially large size precipitate without the formation of a colloid. The colloid formation of heavy metal sulfides can be avoided or minimized by slow addition of the solution of ferrous ions to a solution of sulfide ions at a controlled rate in the absence of heavy metal pollutant ions, and adding the resulting slurry of large particle size precipitate of ferrous sulfide to the stream containing the metal pollutants to be removed. (Sinha-OEIS)  
W79-03778

**SYSTEM AND METHOD FOR COOLING HOT WATER FROM INDUSTRIAL PLANT COOLING USE,**

R. H. Rasmussen.  
U.S. Patent No. 4,117,683, 9 p, 8 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 1, p 49, October 3, 1978.

**Descriptors:** \*Patents, \*Industrial water, \*Thermal pollution, \*Water pollution treatment, \*Water quality control, Water cooling, Cooling water, Harbors, Temperature, Port improvement.

A system for thermal disposal and port improvement comprises an industrial plant constituting a source of hot cooling water which must be cooled. It is located along a navigable river, lake or ocean—the body of water constituting a port. Hot cooling water is delivered from the industrial plant to the port water to cool the water throughout the year and to prevent it from freezing shut in winter. Cool cooling water from the port water is delivered to the industrial plant. The method of cooling hot cooling water from the industrial plant comprises removing the hot cooling water as an effluent stream and directing the stream to the top portion of a holding and cooling lake open to the atmosphere to effect reduction of the temperature by evaporation and conduction, and withdrawing cool cooling water from the bottom portion of the lake and sending it back to the industrial plant for cooling purposes. (Sinha-OEIS)  
W79-03779

**APPARATUS AND METHOD FOR SAMPLING WATER FOR FISH LARVAE AND OTHER TROPHIC LEVELS,**

Lawler, Matusky and Skelly Engineers, Tappan, NY. (Assignee)

For primary bibliographic entry see Field 7B.  
W79-03781

**METHOD FOR SLIME CONTROL,**

H. Finkelstein.  
U.S. Patent No. 4,119,537, 4 p, 2 tab, 5 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 2, p 671, October 10, 1978.

**Descriptors:** \*Patents, \*Water treatment, \*Water purification, \*Industrial water, Water pollution treatment, Water quality control, Slime, Microorganisms, Inhibitors, Pulp and paper industry.

These chemical formulations and agents are to be used as water treatment agents in industrial water systems to control and improve such factors as bacteriological contamination, pollution and cleanliness. Chemical limes, hydrosulfides and dispersants are used together in a formulation, in relatively low concentrations, to primarily inhibit and destroy slime and microorganisms. No toxicants as such are needed. In addition, the chemical lime particles can be coated to give a delayed and safer reaction with water and to give reduced dusting. (Sinha-OEIS)  
W79-03791

**ARRANGEMENT FOR DISPOSING OF FLUID FLOATING MATTER,**  
Mitsui-Osaka Maritime Construction Co. Ltd. (Japan). (Assignee).  
S. Makaya.

U.S. Patent No. 4,119,541, 15 p, 22 fig, 1 tab, 19 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 2, p. 672, October 10, 1978.

**Descriptors:** \*Patents, \*Oil pollution, \*Water pollution treatment, \*Water quality control, Oily water, Red tide, Floating, Separation techniques, Flow separation, Oil recovery.

Floating matter such as red tide or discharged oil floating on water surface, e.g., floating on the ocean surface, can be removed completely. The invention is designed for a small amount of fluid floating matter spreading over a vast area such as rainbow-colored membrane. Also it is possible not only to recover the fluid floating matter but also makes it possible to remove and recover a larger amount of fluid floating matter through a continuous process. A recovery-separation tank is used with an inner water surface lower than that of the outside. The floating matter, such as oil floating on the surface of water outside the recovery-separation tank is drawn in through an inlet. The floating matter and water are separated into layers which flow into the recovery-separation tank and a drain pump discharges the water lying in the lower portion of the tank. (Sinha-OEIS)  
W79-03793

**OIL SLICK REMOVAL AND RECOVERY SYSTEM,**

R. D. Ellis.  
U.S. Patent No. 4,120,788, 9 p, 8 fig, 2 tab, 8 ref; Official Gazette of the United States Patent Office, Vol. 974, No. 3, p 1101, October 17, 1978.

**Descriptors:** \*Patents, \*Oil pollution, \*Water pollution treatment, Water quality control, Absorption, Foaming, \*Oil slicks, Containment, Oil recovery, Foam sandwich.

This system provides a method by which oil slicks are contained, removed and recovered from a water surface by providing a layer of surfactant material, such as foam, under the oil slick and above the oil slick to sandwich the oil. A foam spreading apparatus is provided which includes a floating boom attached to a towing vessel, the boom having spreader units placed above and below the oil slick to discharge the foam forming a sandwich for the oil slick. The apparatus includes a harvesting vessel for cutting and shredding the foam sandwich and a recovery for separating the oil from the strips. (Sinha-OEIS)  
W79-03796

**INVESTIGATION OF THE FEASIBILITY OF DEWATERING BURIED VALLEY SANDS TO AID SEWER-TUNNEL EXCAVATIONS, EDMONTON, ALBERTA,**  
Alberta Research Council, Edmonton. Groundwater Div.

For primary bibliographic entry see Field 8D.  
W79-03824

**PROCEEDINGS OF THE 1977 OIL SPILL RESPONSE WORKSHOP,**

National Coastal Ecosystems Team, NSTL Station, MS.  
Publication No. FWS/OBS/77-24, September 1977. 158 p. Fore, P.L. (Ed.).

**Descriptors:** \*Oil spills, \*Oil pollution, \*Planning, Water pollution effects, Environmental effects, Wildlife habitats, United States, \*Outer Continental Shelf, Pollutant Contingency Plan.

An Oil Spill Response Workshop was held in Metairie (New Orleans), Louisiana, from 15 to 17 February 1977 to improve the Service's capability and effectiveness in responding to oil spills. The workshop was cosponsored by the Office of Migratory Bird Management and the Office of Biological Services, Fish and Wildlife Service, U.S.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

Department of the Interior. The objectives of the workshop were: to discuss overall Service responsibilities, capabilities, and procedures in responding to spills; to disseminate current information concerning biological impacts of oil on wildlife, techniques for minimizing impacts, and other information essential for developing an effective response by the Service to oil spills; to present views of other agencies and organizations on their role in responding to oil spills and their relationship to the U.S. Fish and Wildlife Service; and to critique the recently drafted oil spill contingency plan of the Service and assist in preparing a final plan. (See W79-03831 thru W79-03840)

W79-03830

**STATUS AND FUTURE TRENDS IN OIL SPILLS AND IMPLICATIONS FOR THE U.S. FISH AND WILDLIFE SERVICE,**  
Fish and Wildlife Service, Washington, DC. Office of Migratory Bird Management.

A. E. Fletcher.

In: Proceedings of the 1977 Oil Spill Response Workshop, held Metairie, LA on 15-17 February 1977, Fish and Wildlife Service Biological Services Program Publication No. FWS/OBS/77/24, September 1977, p 11-22, 5 fig, 3 tab, 14 ref.

Descriptors: \*Oil spills, \*Oil pollution, \*Water pollution effects, \*Planning, Wildlife habitats, United States, \*Outer Continental Shelf.

It may not be possible for the U.S. Fish and Wildlife Service to be completely prepared to respond to oil spills at every site where they might occur in the United States, but it is possible to take steps now in those areas where spills are most likely to occur. Service personnel who are located near key oil pollution areas can be assigned to prepare for and respond to pollution incidents; supplies can be stockpiled within easy transport distance to implement bird dispersal and other field actions; surrounding areas can be examined before pollution incidents to determine what locations are known to be particularly critical and should be protected first if threatened by oil; and good communications should be established with State agencies and private organizations that may respond to pollution incidents in these areas. Without such preparation, unnecessarily high direct waterfowl mortality may result and significant indirect fisheries and wildlife losses might result from destruction of important wildlife and fisheries food resources and contamination of breeding areas. The degree of effectiveness of Service actions will be limited considerably by the circumstances of the spill and the species and kinds of habitats involved. However preparations should be made to respond rapidly and effectively in many of these locations where oil spills happen frequently. (See also W79-03830) (Sinha-OEIS)

W79-03831

**NATIONAL OIL AND HAZARDOUS SUBSTANCES POLLUTION CONTINGENCY PLAN AND FEDERAL RESPONSIBILITIES,**  
Environmental Protection Agency, Washington, DC.

R. E. Hess.

In: Proceedings of the 1977 Oil Spill Response Workshop, held Metairie, LA on 15-17 February 1977, Fish and Wildlife Service Biological Services Program Publication No. FWS/OBS/77/24, September 1977, p 23-28, 1 fig.

Descriptors: \*Oil pollution, \*Legislation, \*Water pollution effects, \*Planning, Hazards, Water quality control, Cleaning, Coasts, Estuaries, \*Outer Continental Shelf, National Oil and Hazardous Substances Pollution Contingency Plan, Clean-up, Government coordination, Hazardous substances.

The National Oil and Hazardous Substances Pollution Contingency Plan provides for efficient, coordinated, and effective action to minimize damage from oil and hazardous substances discharges. Possibly, its most important aspect is that of specifying that there should be an On-Scene Coordinator (OSC) to serve as the single Federal executive agent on-scene to direct cleanup and removal operations.

The plan accomplishes its purpose by establishing a flexible organization consisting of the OSC and advisory groups capable of providing expertise and assistance as required. Generally, Federal On-Scene Coordinators are furnished by the Coast Guard for the coastal waters, the Great Lakes and ports and harbors, and by the Environmental Protection Agency (EPA) for inland waters. (See also W79-03830) (Sinha-OEIS)

W79-03832

#### CALIFORNIA'S RESPONSE TO POLLUTION INCIDENTS,

California State Dept. of Fish and Game, Long Beach.

W. H. Putman.

In: Proceedings of the 1977 Oil Spill Response Workshop, held Metairie, LA on 15-17 February 1977, Fish and Wildlife Service Biological Services Program Publication No. FWS/OBS/77/24, September 1977, p 33-36.

Descriptors: \*California, \*Oil spills, \*Planning, Pollution abatement, Environmental effects, Governments, Water quality control, \*Outer Continental Shelf, Pollution Contingency Plans.

The California Oil Spill Contingency Plan reconciles any differences in emergency planning by providing the local governments with all the information developed by the Federal and State On-Scene Coordinators (OSC) and including them in the decisionmaking process at the operation centers. This is accomplished by the local government's preassigning a representative who will have the authority to speak for his community and to commit personnel, equipment, and facilities to help mitigate the pollution incident. He will also have the responsibility to keep his local levels of government informed of the corrective or contemplated actions agreed upon at the operations center. (See also W79-03830) (Sinha-OEIS)

W79-03833

#### INDUSTRY VIEWS AND RESPONSIBILITIES IN OIL SPILL/WILDLIFE OPERATIONS,

American Petroleum Inst., Washington, DC.

K. G. Hay.

In: Proceedings of the 1977 Oil Spill Response Workshop, held Metairie, LA on 15-17 February 1977, Fish and Wildlife Service Biological Services Program Publication No. FWS/OBS/77/24, September 1977, p 37-42.

Descriptors: \*Oil spills, \*Water quality control, \*Water pollution effects, Wildlife conservation, Legislation, Industries, Oil industry, Training, \*Outer Continental Shelf, Cleanup.

Most oil spills—large or small—are directly attributable to human error. The most effective means of preventing spills, therefore, is to employ skilled and attentive crews. To this end, oil companies have developed innovative training programs. The oil industry has conscientiously sought to control and clean up spills and is spending millions of dollars each year on new technologies and training programs to improve tanker efficiency and to reduce the potential for accidents. The petroleum industry has long supported legislation for the establishment of a huge 'superfund,' which could be used immediately to handle expenses involved in the cleanup of spills. The fund would be replenished by the spiller. The American Petroleum Institute (API) has initiated various research projects and other efforts to solve the many complex biological problems that occur in achieving high bird survival levels and a rapid return to the wild and reasonable costs. (See also W79-03830) (Sinha-OEIS)

W79-03834

#### FATE OF OIL IN THE SEA,

Skidaway Inst. of Oceanography, Savannah, GA. For primary bibliographic entry see Field 5C.

W79-03835

**ASSESSING THE BIOLOGICAL IMPACT OF OIL SPILLS: A NEW ROLE FOR EPA BIOLOGISTS,**  
Environmental Protection Agency Edison, NJ. For primary bibliographic entry see Field 5C.

W79-03836

**EFFECTS OF OIL ON AQUATIC BIRDS,**  
Fish and Wildlife Service, Laurel MD. Patuxent Wildlife Research Center. For primary bibliographic entry see Field 5C.

W79-03837

**CONTAINMENT AND RECOVERY TECHNIQUES FOR SPILLED OIL IN THE MARINE ENVIRONMENT,**  
National Coastal Ecosystems Team, NSTL Station, MS.

M. J. Donohoe.

In: Proceedings of the 1977 Oil Spill Response Workshop, held Metairie, LA on 15-17 February 1977, Fish and Wildlife Service Biological Services Program Publication No. FWS/OBS/77/24, September 1977, p 69-82, 15 fig.

Descriptors: \*Oil spills, \*Oil pollution, \*Pollution abatement, \*Water pollution treatment, Environmental effects, Skimming, Equipment, Water quality control, \*Outer continental shelf, \*Oil recovery, Containment.

The containment and recovery of oil discharges through the use of commercially available equipment has resulted in a more timely and efficient response to spill incidents. Appropriate materials or devices are available for use in local conditions throughout the United States. Knowledge of specific equipment limitations and appropriate techniques will result in overall minimization of adverse environmental damage as a result of a spill incident. The fact that one must be prepared to act rapidly, evaluating and programming responses prior to real incidents, is without doubt the most important 'technique' for the containment and recovery of oil spills in the marine environment. (See also W79-03830) (Sinha-OEIS)

W79-03838

**CHEMICAL OIL DISPERSING AGENTS AND THEIR FEASIBILITY FOR USE,**  
Exxon Research and Engineering Co., Florham Park, NJ.

G. P. Canevari.

In: Proceedings of the 1977 Oil Spill Response Workshop, held Metairie, LA on 15-17 February 1977, Fish and Wildlife Service Biological Services Program Publication No. FWS/OBS/77/24, September 1977, p 83-94, 4 fig, 1 tab, 8 ref.

Descriptors: \*Oil spills, \*Water pollution treatment, Pollution abatement, Dispersion, Equipment, Mixing, Surfactants, \*Outer Continental Shelf, Chemical dispersants.

There is increased recognition that there is a role for chemical dispersants in minimizing damage from oil spills. The improved effectiveness afforded by the self-mix dispersant system has been demonstrated. In addition, several organizations are planning major field demonstrations of this type of dispersant system. In these experiments, the water column will be sampled in the environs of the dispersed oil in order to establish the rate of dilution of oil concentration. The resolution of this important aspect (i.e., the dilution and resultant toxicity of dispersed oil) will help place the various laboratory bioassays, wherein dilution of the dispersed oil concentration is not considered, in a more proper perspective. Conventional (mixing required) dispersants will continue to be used in the immediate future where mixing energy is conveniently available and the spill size is relatively small. Hardware (sprays, booms, mixing breaker boards, etc.) have been well-developed for boat applications. In this regard, some dispersants are now formulated as concentrates (high surface-active agent content) for greater oil-to-chemical treatment ratios, thereby permitting workboats to

remain on supplies. W79-03838

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## Water Quality Control—Group 5G

remain on station longer before having to replenish supplies. (See also W79-03830) (Sinha—OEIS) W79-03839

## RESTORATION OF OIL-CONTAMINATED SHORELINES,

URS Co., San Mateo, CA.

R. W. Castle.

In: Proceedings of the 1977 Oil Spill Response Workshop, held Metairie, LA on 15-17 February 1977, Fish and Wildlife Service Biological Services Program Publication No FWS/OBS/77-24, September 1977, p 105-112, 2 ref.

Descriptors: \*Oil spills, \*Beaches, \*Shores, \*Coasts, \*Water pollution effects, Environmental effects, Sediments, \*Outer Continental Shelf, Cleanup.

With the possible exception of the use of heavy equipment for sandy beach cleaning, a definitive and effective state-of-the-art for restoration of oil-contaminated shorelines is nonexistent. However, common sense applications of the knowledge and resources that are presently available can provide acceptable interim actions. Each restoration situation has its own peculiarities and requirements. If several basic assumptions are adhered to, the best practical restoration decisions should result. These assumptions include: any activity will have some effect on the environment. The restoration procedure and supporting activities (i.e., access, disposal, etc.) must not result in more environmental damage than caused by the oil itself. The restoration procedure should remove (or move to a position where recovery is possible) a maximum amount of contaminant with a minimum amount of disturbance, modification, or removal of the habitat. Extensive efforts resulting in low recovery yields are generally antiproductive and should be avoided. In some cases, no action at all is a viable alternative. (See also W79-03830) (Sinha—OEIS) W79-03840

## ECONOMIC ANALYSIS, ROOT CONTROL, AND BACKWATER FLOW CONTROL AS RELATED TO INFILTRATION/INFLOW CONTROL,

American Public Works Association, Chicago, IL. R. H. Sullivan, R. S. Gemmill, L. A. Schaefer, and W. D. Hurst.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 052, Price codes: A07 in paper copy, A01 in microfiche. Report EPA-600/2-77-017a, December 1977, 102 p, 17 fig, 13 tab, 17 ref. 803151.

Descriptors: \*Root control, \*Backwater, \*Roots, \*Tide gates, \*Sewers, \*Costs, Sewerage, Cost-effectiveness, Economics, Infiltration, Inflow, Root systems, Flooding, Herbicides, Vaporooter, Mechanical control, Chemcontrol, Pipes, Backwater gates, Manholes.

On-site investigations and questionnaires were used to compile information (including costs) on control and elimination of infiltration/inflow flows to sanitary sewer systems. Major sources of infiltration are pipe defects, manholes, service connections, and poor initial construction. Major inflow sources are open manholes, roof leaders, illegal connections, catch basins, and yard and ground drains. It is seldom cost-effective to correct all infiltration points and some types of inflow. Intrusion of tree and shrub roots is a major sewer system problem. Mechanical cleaning is initially effective, but seems to cause worse root problems later. Of chemical control methods, Vaporooter is the most effective and is considered safe for employees and surface plants with recommended precautions. Foam also appears effective, but flooding or application of chemicals through manholes are not recommended. Roots can be excluded by use of newly developed pipe and sealer designs. Tide gates are considered satisfactory, though frequent maintenance is required to correct fouling and sticking, which represent about 60% of malfunctions. Only 7% of gate failures are reported due to corrosion. A major problem is accessibility. Cast iron gates have a longer service life than timber gates and steel

pontoon gates, which decay or corrode after about 10 years. Three additional volumes (Appendices, Product and Equipment Guide, and Manual of Practice) accompany this report. (Lynch-Wisconsin) W79-03841

## PERMISSIBLE POLLUTION LEVELS OF WATER BODIES,

Moscow State Univ. (USSR). Dept. of Biology. N. S. Stroganov.

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Volume I, Environmental Protection Agency, Report EPA-600/3-78-076, p 1-10, 1978. 3 fig, 1 tab.

Descriptors: \*Water quality standards, \*Water quality control, \*Self purification, \*Waste assimilative capacity, USSR, Baseline studies, Water quality, Water chemistry, Microorganisms, Industrial wastes, Chemical wastes, Nitrification, Microbial degradation, Chemical degradation, Biochemical oxygen demand, \*Mineralization.

In order to establish the maximum permissible level of pollution, beyond whose limits one cannot go without disrupting the use of the water, one should: first, determine the chief water users for multiple utilization of the water body, and, secondly, determine the main water quality requirements. The maximum permissible level of pollutant emission is limited by the water body's processes of self-purification, especially microorganisms. Their capability and the rate of decomposition of pollutants must be appropriate to the quality and quantity of pollutants discharged. (See also W79-03906) (EIS-Deal) W79-03907

## A BRIEF HISTORY OF WATER POLLUTION RESEARCH IN UNITED STATES,

C. M. Tarzwell.

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. I, Environmental Protection Agency, Report EPA-600/3-78-076, p 11-31, 1978.

Descriptors: \*Water quality standards, \*Water quality control, \*Regulation, Bioindicators, Bioassay, Legislation, Water Quality Act, Water quality, Federal Water Pollution Control Act, Fish populations, Toxicity, Research and development, Waste treatment, Self-purification, Public health, Aquatic populations, Water supply, Disinfection, Water treatment.

The research for detection, evaluation, and abatement of water pollution is described under five major headings: (1) water supply studies; (2) pollution surveys and studies of natural purification and biological indicators of pollution; (3) treatment of organic wastes; (4) development, use, and standardization of bioassay methods; and, (5) determination of water quality requirements for aquatic life and development of water quality standards. Early developments are discussed in detail. Description of developments since 1948 are largely confined to legislative activities aimed at water pollution. (See also W79-03906) (EIS-Deal) W79-03908

## THE ROLE OF ALGAE IN THE POLLUTION OF RESERVOIRS AND PROBLEMS OF CONTROLLING THEIR NUMBERS,

Moscow State Univ. (USSR).

For primary bibliographic entry see Field 5C. W79-03914

## EUTROPHICATION IN THE UNITED STATES: PAST-PRESENT-FUTURE,

A. F. Bartsch, K. W. Malueg, C. F. Powers, and T. E. Maloney.

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. I, Environmental Protection Agency, Report EPA-600/3-78-076, p. 87-91, 1978. 3 tab, 18 ref.

104, 1978. 4 fig, 9 ref.

Descriptors: \*Eutrophication, \*Lakes, \*Limnology, Nutrients, Algae, Algal control, Zooplankton, Water chemistry, Water analysis, Nutrient removal, Water quality, Water quality control, Productivity, Trophic level, Nitrogen, Phosphorus, Alicides, Biocontrol, Water quality standards.

First, a brief history of cultural eutrophication and attempts at analysis and correction is presented. Second, present techniques of analysis and control are discussed. Particular attention is given to the carbon problem, nutrient loading, algal assays, product modification, in-lake treatment and legislation. Lastly, areas of deficient knowledge are pointed out for future research. (See also W79-03906) (EIS-Deal) W79-03915

## THE IMPORTANCE OF TROPHIC BONDS IN THE BACTERIAL DESTRUCTION OF ORGANIC MATTER,

Akademii Nauk SSSR, Moscow. Inst. Biologii Vnutrennykh Vod.

For primary bibliographic entry see Field 5C. W79-03919

## FISH-POPULATION STUDIES IN THE OHIO RIVER,

For primary bibliographic entry see Field 5C. W79-03921

## SEA LAMPREY (PETROMYZON MARINUS LINNAEUS) IN THE SAINT LAWRENCE GREAT LAKES OF NORTH AMERICA: EFFECTS, CONTROL, RESULTS,

For primary bibliographic entry see Field 5C. W79-03925

## PRINCIPLES AND METHODS OF BIOLOGICAL ESTABLISHMENT OF THE NORMS OF CHEMICAL SUBSTANCES AND EVALUATION OF THE LEVEL OF POLLUTION IN WATER-BODIES,

Tsentrally Nauchno-Issledovatel'skii Inst. Osetrovoj khozyaistva, Astrakhan (USSR).

V. I. Lukyanenko.

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. II, Environmental Protection Agency, Report EPA-600/3-78-076, p. 28-33, 1978, 11 ref.

Descriptors: \*Water pollution effects, \*Monitoring, \*Standards, \*Toxicity, Industrial wastes, Domestic wastes, Bioassays, Methodology, Public health, Commercial fisheries, Insecticides, Pesticides, Water quality, Ecology, Aquatic toxicology, Fish physiology, Animal behaviour.

The principles and methods for establishing biological standards for chemical substances discharged into water are considered. The methods of evaluating the level of pollution in water bodies require further development. (See also W79-03906) (EIS-Katz) W79-03929

## A RESEARCH SYSTEM FOR DEVELOPING FISHERIES STANDARDS FOR WATER QUALITY, CONSIDERING THE PECULIARITIES OF TRANSFERRING EXPERIMENTAL DATA TO NATURAL WATER BODIES,

L. A. Lesnikov.

In: Proceedings of the First and Second USA-USSR Symposia on the Effects of Pollutants Upon Aquatic Ecosystems - Vol. II, Environmental Protection Agency, Report EPA-600/3-78-076, p. 83-91, 1978. 3 tab, 18 ref.

Descriptors: \*Daphnia, \*Standards, \*Monitoring, Phytoplankton, Zooplankton, Freshwater fish, Toxicity, Mortality, Benthos, Freshwater fish, Bioassays, U.S.S.R., Fisheries statistics, Water pollution effects, Methodology.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

The author describes the consideration involved in using laboratory data and other biological data to develop standards for the protection of water bodies of the USSR. Data obtained with bioassays with algae, zooplankton, phytoplankton, zoobenthos, fish and reducing bacteria are used. (See also W79-03906 (EIS-Katz) W79-03933

#### NATIONAL CONFERENCE ON MANAGEMENT OF NITROGEN IN IRRIGATED AGRICULTURE

Proceedings of National Conference held in Sacramento, California, May 15-18, 1978. Sponsored by National Science Foundation, Environmental Protection Agency, University of California. Published by the Department of Soil and Environmental Sciences, University of California, Riverside, 1978. 442 p. \$13.00.

Descriptors: \*Nitrogen, \*Nitrogen cycle, \*Nitrates, \*Irrigated land, Water quality, Water management (Applied), \*Conferences.

These proceedings represent a National Conference on Nitrogen Management in Irrigated Lands, designed to bring together users representing a diversity of interests throughout the country for an integrated review of the findings from the comprehensive national research effort. The accumulated information needs to be utilized as fully as possible by the many individuals and organizations making decisions in current water quality planning. This will help ensure the emergence of appropriate and viable solutions to our water quality problems—solutions that are sensitive to both local and national needs and priorities. (See W79-03942 thru W79-03959) (Skogerboe—Colorado) W79-03941

#### NITROGEN FORMS AND CYCLING IN RELATION TO WATER QUALITY

Agricultural Research Service, Duran, OK.

Water Quality Management Lab.

R. G. Menzel.

In: National Conference on Management of Nitrogen in Irrigated Agriculture, p 33-52, 1978. 3 tab, 43 ref.

Descriptors: \*Water quality, \*Nitrogen, Nitrogen compounds, \*Nitrogen cycle, Nitrogen fixation, Denitrification, Eutrophication.

The intended use of water determines the significance of various forms of nitrogen in water quality. Upper limit concentrations have been recommended for several forms of nitrogen in water used for public water supplies, freshwater aquatic life, marine aquatic life, and agricultural uses. The concentrations are lowest for cyanide, and increase in the order ammonium, nitrite, and nitrate. Nevertheless, nitrate is more often of concern in water quality than are the first three forms of nitrogen. Much of the total nitrogen in surface waters occurs in particulate or dissolved organic forms. Plant growth is often excessive when the total nitrogen concentration exceeds 0.5 mg/l if other nutrients are adequately supplied and growth conditions are favorable. Nitrogen supply limits growth in many ocean areas and in a few lakes, mainly eutrophic ones. Nitrogen fixation by blue-green algae tends to correct nitrogen deficiencies. Denitrification by bacteria tends to correct excesses. These features indicate that high nitrogen concentrations may be an effect, rather than a cause, of eutrophication. (See also W79-03941) (Skogerboe—Colorado) W79-03943

#### SOURCES OF NITROGEN FOR CROP UTILIZATION

Potash/Phosphate Inst. Manhattan, KS.

L. S. Murphy.

In: National Conference on Management of Nitrogen in Irrigated Agriculture, p 61-107, 1978. 23 tab, 40 ref.

Descriptors: \*Nitrogen, Fertilizers, \*Crop production, Nitrogen fixation, Corn (Field), Soybeans, Al-

falfa, Symbiosis, Ammonium compounds, \*Irrigation water, Water pollution control.

Nitrogen fertilization of crops is essential for maximum food production. Nitrogen from organic matter in the soil declines with continued cultivation to the point that supplemental nitrogen applications are necessary. Supplemental sources of nitrogen for crop production include symbiotically fixed nitrogen from legumes, nonsymbiotically fixed nitrogen from free-living organisms in the soil, inorganic nitrogen from lightning discharges and industrial emissions, industrially fixed nitrogen and nitrogen from various waste products. Recommendations for nitrogen applications in either dryland or irrigated agriculture are based on crop need as determined by agricultural research. Soil analysis is an important tool in determination of needs. Use of present and future recommendations will both maximize production of food and maintain environmental quality. (See also W79-03941) (Skogerboe—Colorado State) W79-03944

#### MINERALIZATION, IMMOBILIZATION AND NITRIFICATION

California Univ., Davis. Dept. of Land, Air and Water Resources.

For primary bibliographic entry see Field 2K. W79-03945

#### REMOVAL OF NITROGEN BY VARIOUS IRRIGATED CROPS

Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.

For primary bibliographic entry see Field 3F. W79-03946

#### VOLATILE LOSSES OF NITROGEN FROM SOIL

California Univ., Davis. Dept. of Land, Air and Water Resources.

For primary bibliographic entry see Field 3F. W79-03947

#### LEACHING OF NITRATE FROM SOILS

Washington State Univ., Pullman. Dept. of Agronomy and Soils.

B. L. McNeal, and P. F. Pratt.

In: National Conference on Management of Nitrogen in Irrigated Agriculture, p 195-230, 1978. 4 fig, 5 tab, 35 ref.

Descriptors: \*Nitrates, Nitrogen, \*Leaching, Irrigated land, Denitrification, Waste disposal, Soils.

Calculation of soil solution nitrate concentrations, and of mass emissions of nitrate, are illustrated. Estimation of average water flux from nitrate/chloride ratios, and from drain field outflows, are discussed. The high potential for nitrate leaching from irrigated animal and municipal waste disposal sites is mentioned, with stress being placed on the high denitrification potential at many such sites, because of high soluble carbon loadings, high soil microbe levels, and rapid oxygen depletion. Root-zone and subsoil nitrate-nitrogen values are provided for typical croplands of southern California and central Washington. Such values are related to irrigation management and to downward water flux. Crop differences in ability to utilize all soluble nitrate from the soil solution are stressed, and some management alternatives for preventing deep percolation losses of nitrate are detailed. Predictions of nitrate leaching losses from data for nitrogen application rate and drainage water volume are discussed. Typical predictions are presented and are compared to experimentally-measured values. Overprediction of nitrate leaching estimates for some furrow-irrigated tracts in the Pacific Northwest is demonstrated. (See also W79-03941) (Skogerboe—Colorado State) W79-03948

#### EFFECT OF WATER MANAGEMENT ON NITRATE LEACHING

California Univ., Riverside. Dept. of Soil and En-

vironmental Sciences.

For primary bibliographic entry see Field 3F. W79-03949

#### MONITORING WATER FOR NITROGEN LOSSES FROM CROPLANDS

California Univ., Davis. Dept. of Land, Air and Water Resources.

K. K. Tanji.

In: National Conference on Management of Nitrogen in Irrigated Agriculture, p. 251-263, 1978. 10 ref.

Descriptors: \*Nitrogen, \*Return flow, Irrigated lands, \*Monitoring, Water quality.

This paper reviews monitoring for nitrogen in surface and subsurface return flows from irrigated lands. Presented are the elements of a monitoring program: objectives of monitoring, parameters to be measured, sampling programs that include site selection, sampling frequency and sampling method, laboratory methods for nitrogen determinations, requirements for resources and facilities, evaluations of collected data and other supporting information and data, and dissemination of monitored results. Each of these elements are appraised and a conclusion is drawn on monitoring waters for nitrogen losses from croplands. (See also W79-03941) (Skogerboe—Colorado State) W79-03950

#### ESTIMATING THE INFLUENCE OF SOIL RESIDENCE TIME ON EFFLUENT WATER QUALITY

California Univ., Riverside. Dept. of Soil and Environmental Sciences.

W. A. Jury.

In: National Conference on Management of Nitrogen in Irrigated Agriculture, p 265-290, 1978. 6 fig, 1 tab, 35 ref.

Descriptors: \*Effluents, \*Water quality, Travel time, Drainage, Tile drainage, Nitrates, Soils.

Models are proposed to calculate the time required for dissolved chemicals to move from the soil surface to either underlying groundwater in the case of free drainage or to tile drain outlets in the case of artificial drainage. The models assume that dissolved substances are transported primarily by moving soil solution, which displaces soil water initially present in the wetted pore space (piston flow approximation). For free drainage, this results in a single travel time equation which is a function of soil water content and drainage volume. For tile drainage, the travel time depends also on the surface entry point, which is illustrated with a graph showing residence time as a function of place of origin. This graph may be used for all tile drain systems. Calculations are presented to show the influence of travel time on drainage concentrations, illustrating also how tile drain concentrations are a mixture of contributions from different parts of the field arriving at different times. Field studies of salt movement are analyzed and compared to the model predictions, with differences explained on the basis of soil variability or stagnant water in part of the wetted pore space. (See also W79-03941) (Skogerboe—Colorado State) W79-03951

#### USE OF MATHEMATICAL RELATIONSHIPS TO DESCRIBE THE BEHAVIOR OF NITROGEN IN THE CROP ROOT ZONE

Florida Univ., Gainesville. Dept. of Soil Science.

For primary bibliographic entry see Field 3F. W79-03952

#### DIAGNOSTIC TECHNIQUES USED TO IDENTIFY OPTIMUM LEVELS OF NITROGEN FERTILIZATION FOR IRRIGATED CROPS

Oregon State Univ., Corvallis. Dept. of Soil Science.

For primary bibliographic entry see Field 3F. W79-03953

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## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Water Quality Control—Group 5G

#### ECONOMIC CONCEPTS AND POLICIES RELATED TO CONTROLLING NON-POINT SOURCE POLLUTION STEMMING FROM AGRICULTURE

Washington State Univ., Pullman. Dept. of Agricultural Economics.

N. K. Whittlesey, and P. W. Barkley.

In: National Conference on Management of Nitrogen in Irrigated Agriculture, p 333-353, 1978. 14 ref.

Descriptors: Pollution abatement, Water pollution sources, Agriculture, \*Nonpoint pollution sources, Water pollution control.

This paper describes the role of economics in solving non-point source pollution problems in terms that are understandable for the noneconomist. An economist attempts to watch over the process of converting natural resources into marketable commodities to assure that the process achieves the greatest possible good for members of society. Economic tools are well equipped to handle this process for goods and resources known as private property, those items used exclusively by the individual owners. Unfortunately, most pollution problems occur through the use and misuse of public property, those items owned and used jointly by all members of society. Air and water are the most common examples of public property. The paper describes economic concepts and public policies that are useful for internalizing the costs caused by pollution and abating or solving pollution caused problems. The concepts of opportunity cost and income distribution and their role in pollution abatement are discussed. Methods of choosing levels of abatement include the extremes of zero pollution and that which can be achieved by best management practices. The economic and social optimum probably lies between these extremes. Arbitrary standards are sometimes imposed as a compromise between the extremes of zero pollution and no abatement in an effort to approximate optimal levels of abatement. (See also W79-03941) (Skogerboe-Colorado State)

W79-03954

#### A CASE STUDY-NITRATES IN THE UPPER SANTA ANA RIVER BASIN IN RELATION TO GROUNDWATER POLLUTION

California Univ., Davis. Dept. of Land, Air and Water Resources.

For primary bibliographic entry see Field 5B.

W79-03955

#### ECONOMIC IMPACTS OF CONTROLLING NITROGEN CONCENTRATION AND OTHER WATER QUALITY DETERMINANTS IN THE YAKIMA RIVER BASIN

North Dakota State Univ., Fargo. Dept. of Agricultural Economics.

G. H. Pfeiffer, and N. K. Whittlesey.

In: National Conference on Management of Nitrogen in Irrigated Agriculture, p 415-442, 1978. 4 fig, 4 tab, 9 ref.

Descriptors: Water quality, \*Nitrogen, \*Economic impact, \*Return flow, Pollution abatement, \*Washington, \*Yakima River Basin (Wash).

The nonpoint source nature of water quality degradation caused by irrigation return flow makes control nearly impossible with traditionally effective measures, such as limitations or taxes on effluents. As a consequence, control or taxation of those inputs to production which are involved in effluent input-output relationships is a possible alternative. In the Yakima River Basin, three determinants of river water quality were identified: nitrogen concentration, river water temperature, and soil erosion by irrigation water. Among the pollution control policies considered for effectiveness, producer cost, and social cost were taxation of nitrogen fertilizer, increasing the charge for irrigation water, reduction of irrigation water rights, and restrictions on the types of irrigation systems used. Results showed that policies which affect the level of one pollutant may or may not significantly affect the levels of others. Furthermore, policies taxing or charging for inputs, such as fertilizer and

irrigation water, cause a substantial reduction in producer income if acceptable water quality is to be attained. Therefore, water quality policy formulation and evaluation should consider the interactions which exist among water quality determinants and considerations of both the expected benefits of improved water quality and the level and distribution of improvement costs. (See also W79-03941) (Skogerboe-Colorado State)

W79-03956

#### NITROGEN BALANCES FOR THE SANTA MARIA VALLEY

California Univ., Riverside. Dept. of Soil and Environmental Sciences.

L. J. Lund, J. C. Ryden, R. J. Miller, A. E. Laag, and W. E. Bendixen.

In: National Conference on Management of Nitrogen in Irrigated Agriculture, p 395-413, 1978. 6 tab, 7 ref.

Descriptors: \*Nitrogen, Nutrient removal, Denitrification, Vegetable crops, Leaching, \*Santa Maria Valley (Calif), \*California model studies.

A simplified steady-state model has been used to develop nitrogen balances in the Santa Maria Valley, California. Balances have been developed for selected management units and for the valley as a whole. The balance developed for a field cropped with vegetables for the past twelve years showed that 30% of the applied nitrogen was removed in harvested crop, 37% was leached below the root zone and 33% was unaccounted for, which was attributed to gaseous losses of nitrogen as products of denitrification. Direct field measurement of denitrification over an eight-month period at one site in the same field found a 29% loss of the applied nitrogen. The first estimation of the nitrogen balance in the valley attributed 24% of the applied nitrogen to removal in harvested crops, 39% to leaching and 37% to denitrification. (See also W79-03941) (Skogerboe-Colorado State)

W79-03957

#### AN ECONOMIC METHODOLOGY FOR EVALUATING 'BEST MANAGEMENT PRACTICES' IN THE SAN JOAQUIN VALLEY OF CALIFORNIA

Economics, Statistics, and Cooperatives Service, Washington, DC.

G. L. Horner, D. J. Dudek, and R. B. McKusick.

In: National Conference on Management of Nitrogen in Irrigated Agriculture, p 369-393, 1978. 1 fig, 1 tab, 20 ref.

Descriptors: Return flow, \*Economic prediction, Water quality, \*Management, Environmental effects, Economics, \*Methodology, \*California, \*San Joaquin Valley (Calif).

Section 208 of Public Law 92-500 (The Federal Water Pollution Control Act Amendments of 1972) requires the preparation of areawide waste treatment management plans. Agricultural related pollutants such as subsurface drainage water and irrigation tailwater containing nutrients, sediment and pesticides must be identified and procedures and methods to control such discharges specified. Under Section 208, the reduction of pollutants may be achieved by adopting a set of 'best management practices' that could include varying economic incentives, establishing resource use controls and suggesting public resource investment. To determine the economic and environmental impact of 'best management practices,' a methodology must be derived that specifies the relationship of agricultural production practices to water and land quality and the economic cost and benefits of changing those practices. Such a methodology is being developed to systematically collect and organize physical and economic data, specify the physical and economic relationships and estimate the changes in agricultural production, income, employment and resource demands from proposed 'best management practices.' (See also W79-03941) (Skogerboe-Colorado State)

W79-03958

#### OVERVIEW OF NITROGEN IN IRRIGATED AGRICULTURE

California Univ., Davis. Cooperative Extension.

R. S. Rauschkolb.

In: National Conference on Management of Nitrogen in Irrigated Agriculture, p 53-60, 1978. 3 ref.

Descriptors: Water quality, \*Nitrogen, \*Pollution abatement, Pollutant identification, Fertilization, Water management (Applied), \*Irrigated land, Water law.

Events of the recent past have been moving agriculture rapidly towards the point where it can no longer afford the luxury of being concerned with production of food and fiber alone. One of the principle reasons for the change in attitudes has been the Federal Water Pollution Control Act Amendment of 1972, commonly referred to as Public Law 92-500. Within this law there is a section dealing with areawide planning, Section 208. Under this section each state is to develop waste water management strategies which indicate methods for control or treatment of all point and nonpoint sources of pollution within an area. Specific outputs resulting from Section 208 area-wide planning include a regulatory program to control or treat all point and nonpoint pollution sources, including in-place or accumulated pollution sources. This represents only one of the many outputs that are expected from area 208 planning, but it is one that seems to be the most important with respect to nitrogen management in irrigated agriculture. (See also W79-03941) (Skogerboe-Colorado State)

W79-03959

#### SAND AND GRAVEL OFFSHORE IN THE GREATER NEW YORK METROPOLITAN AREA: WHAT KIND AND HOW MUCH

New York Sea Grant Inst., Albany.

For primary bibliographic entry see Field 2L.

W79-03963

#### POLLUTION CONTROL GUIDELINES FOR COAL REFUSE PILES AND SLURRY PONDS

Wahler (W. A.) and Associates, Palo Alto, CA. Report No. EPA-600/7-78-222, November 1978. 223 p, 66 fig, 49 tab, 24 ref, 2 append. 68-03-2344, 68-03-2431.

Descriptors: \*Coal mine wastes, \*Waste disposal, \*Water pollution sources, \*Reclamation, \*Pollution abatement, Water pollution control, Mine acids, Settling basins, Waste dilution, Sediment transport, Sediment discharge, Sediment load, Vegetation effects, Publications, Technology, Sampling.

A study undertaken to develop guidelines for construction, operation, and reclamation of coal refuse piles and slurry ponds is reported. Detailed air and water quality sampling programs were carried out at eight active refuse pile sites and six slurry pond sites in the eastern coal-mining regions. Information is presented on: pollution mechanism; the physical and chemical properties of coal refuse; coal preparation plant processes and procedure; site selection; conveyance systems for transporting refuse from plant to disposal area; and site abandonment and reclamation. Alternative techniques for refuse disposal and pollution control applicable to specific situations are discussed. It was generally concluded from the literature search, interviews and the field study program that technology is currently available for the construction of refuse disposal and reclamation facilities which can operate in an environmentally acceptable manner. (Davison-IPA)

W79-03968

#### SOURCE ASSESSMENT: OPEN MINING OF COAL, STATE OF THE ART

Monsanto Research Corp., Dayton, OH.

S. J. Rusek, S. R. Archer, R. A. Wachter, and T. R. Blackwood.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 497. Price codes: A06 in paper copy, A01 in microfiche.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

Report No. EPA-600/2-78-004X, September 1978. 86 p, 11 fig, 10 tab, 59 ref, 3 append. 68-02-1874.

Descriptors: \*Air pollution, \*Coal mines, \*Pollution abatement, \*Reviews, \*Strip mines, Air pollution effects, Hazards, Pollutant identification, Drilling equipment, Overburden, Wind erosion, Dusts, Safety.

The potential environmental effects of atmospheric emissions from the open mining of coal are evaluated using source severity values. In open coal mining there are seven unit operations or subprocesses involving excavation of overburden, removal of the coal, and coal transport. The only hazardous emissions are respirable dusts which are generated by five of the subprocesses and wind erosion. Total dust loading from these sources are: coal transport and unloading, 40%; blasting, 30%; coal loading, 14%; drilling, 12%; coal augering, 1%; and wind erosion, 3%. The emission factors for the unit operations indicate that 13 g of respirable dust are emitted per metric ton of coal mined. Control technology has been effected for drill rigs, haul roads, and coal refuse piles. Cyclones and water sprays are employed on the larger drills to control particulates. Water spraying of haul roads for dust reduction and safety is enforced by most states. Gaseous pollutants from stagnant coal piles are controlled by shielding the piles from the wind, applying cooling process, or removing the carbonaceous material. Currently the open coal mining industry has a growth rate of 3.5%/year; the growth factor for the industry is 1.23. (Davison-IPA) W79-03969

OHIO RIVER BASIN ENERGY STUDY, ORBES PHASE I: INTERIM FINDINGS, Illinois Univ., Urbana-Champaign. For primary bibliographic entry see Field 6G. W79-03971

PRELIMINARY ENVIRONMENTAL ASSESSMENT OF BIOMASS CONVERSION TO SYNTHETIC FUELS, Battelle Columbus Labs., OH. S. T. DiNovo, W. E. Ballantyne, L. M. Curran, W. C. Baytos, and K. M. Duke. Available from the National Technical Information Service, Springfield, VA 22161 as PB-289 775, Price codes: A16 in paper copy, A01 in microfiche. Report No. EPA-600/7-78-204, October 1978. 363 p, 70 fig, 121 tab, 261 ref. 68-02-1323.

Descriptors: \*Biomass, \*Fuels, \*Municipal wastes, Aquaculture, Forestry, Hydrogenation, Hydrolysis, Environmental effects, Forest management, Energy conversion, Biochemistry, Agricultural wastes.

The technological aspects of biomass production and conversion and their associated environmental effects are examined. Details of five categories are given: (1) agricultural and forestry wastes; (2) aquaculture; (3) silviculture; (4) energy crops; and (5) urban and industrial wastes. The primary thermochemical processes reviewed in detail include direct conversion, pyrolysis, and acid hydrolysis, and the lesser developed technologies, hydrogenation and naval stores are briefly analyzed. The primary biochemical processes, anaerobic digestion and enzymatic hydrolysis, are detailed, and the secondary processes, methanol and other Fischer-Tropschtype products from synthesis gas, ethanol production from sugar solutions, and other minor process systems, are evaluated. A series of six regionalized scenarios which examine the environmental implications of different conversion technologies applicable to different geographical areas of the U.S. are presented. It is concluded that the development of biomass sources of synthetic fuels could potentially satisfy 3 to 8% of the projected U.S. energy demand by the turn of the century. However, the development of biomass sources should be in concert with localized energy needs. It is also concluded that since the development of biomass conversion is in the early stages of development, technology and environmental protection can develop simultaneously. (Davison-IPA)

W79-03973

ENVIRONMENTAL EFFECTS OF OIL SHALE MINING AND PROCESSING, PART 1: FISHES OF PICEANCE CREEK, COLORADO, PRIOR TO OIL SHALE PROCESSING, Colorado Div. of Wildlife, Fort Collins. Fisheries Research Center.

For primary bibliographic entry see Field 5C. W79-03974

ENVIRONMENTAL EFFECTS OF OIL SHALE MINING AND PROCESSING, PART II: THE AQUATIC MACROINVERTEBRATES OF THE PICEANCE BASIN, COLORADO, PRIOR TO OIL SHALE PROCESSING,

Colorado State Univ., Fort Collins. Dept. of Zoology; and Colorado State Univ., Fort Collins. Dept. of Entomology.

For primary bibliographic entry see Field 5C. W79-03975

RESULTS OF RESEARCH RELATED TO STRATOSPHERIC OZONE PROTECTION, REPORT TO CONGRESS, SRI International, Menlo Park, CA.

For primary bibliographic entry see Field 5A. W79-03977

SAMPLING AND ANALYSIS RESEARCH PROGRAM AT THE PARAHO SHALE OIL DEMONSTRATION,

TRW Environmental Engineering Div., Redondo Beach, CA.

For primary bibliographic entry see Field 5A. W79-03980

LINERS FOR SANITARY LANDFILLS AND CHEMICAL AND HAZARDOUS WASTE DISPOSAL SITES,

Ebon Research Systems, Silver Spring, MD.

S. A. Ware, and G. S. Jackson. Report No. EPA-600/9-78-005, May 1978. 92 p, 9 fig, 17 tab, 22 ref, 2 append. 68-03-2460-4.

Descriptors: \*Landfills, \*Linings, \*Sewage lagoons, \*Waste storage, Waste dumps, Chemical wastes, Municipal wastes, Hazardous wastes, Plastic films, Solid wastes, Holding ponds, Waste disposal, Ponds, Inhibitors.

Sanitary landfills, chemical and hazardous waste disposal sites, and holding ponds with an impermeable lining are identified, listed, and briefly described. The term 'liner' is defined as a variety of materials that can be installed at the base and around the perimeter of a sanitary landfill to prevent leachate from entering ground and surface waters and to impede migration of gases across the fill before venting to the atmosphere. Liners listed include polyethylene, chlorinated polyethylene, polyvinyl chloride, Hypalon R, ethylene propylene diene monomer, butyl rubber, conventional paving asphalt, hot sprayed asphalt, asphalt-sealed fabric, concrete and various treated and untreated soil mixtures, such as compacted clay, pure montmorillonite and montmorillonite mixed with concrete. Three methods are evaluated for excavating a fill to retrieve a small portion of liner for laboratory analysis: use of the dragline, the back hoe, and the caisson. Costs for each of the methods are given. (Davison-IPA) W79-03985

MERCURY, LEAD, ARSENIC, AND CADMIUM IN BIOLOGICAL TISSUE. THE NEED FOR ADEQUATE STANDARD REFERENCE MATERIALS,

Environmental Monitoring and Support Lab., Las Vegas, NV.

For primary bibliographic entry see Field 5A. W79-03995

SIZE DEPENDENT MODEL OF HAZARDOUS SUBSTANCES IN AQUATIC FOOD CHAIN,

Manhattan Coll., Bronx, NY. For primary bibliographic entry see Field 5C. W79-03997

### 6. WATER RESOURCES PLANNING

#### 6A. Techniques Of Planning

OPTIMAL SEQUENCING FOR A MULTIPURPOSE WATER SUPPLY SYSTEM,

Banyaszati Kutato Intezet, Budapest (Hungary). For primary bibliographic entry see Field 4A. W79-03518

WATER RESOURCES CONTROL THROUGH SYSTEMS ANALYSIS,

International Inst. for Applied Systems Analysis, Laxenburg (Austria). For primary bibliographic entry see Field 4A. W79-03519

APPLICATION OF DECISION THEORY TO SALMON MANAGEMENT,

Department of the Environment, Vancouver (British Columbia). Inland Waters Directorate (Pacific Region).

S. W. Sheehan, and S. O. Russell. Water Resources Research, Vol. 14, No. 5, p. 976-980, October 1978. 4 fig, 2 tab, 14 ref.

Descriptors: \*Salmon, \*Management, \*Spawning, \*Skeena River fishery (BC), Canada, Real time, Forecasting, Probability, Equations, Mathematical models, Systems analysis, \*Bayesian decision theory, Utility curve, Escapement, Renewable resources.

Bayesian decision theory provides concepts that seem ideally suited to many renewable resource management problems. A procedure for applying the concepts to salmon management in real time is illustrated with an example from the Skeena River fishery in Northern British Columbia, Canada. The decision in question is the escapement to allow for spawning purposes in a particular year. The procedure involves determining a probabilistic relationship between the escapement in one year and the number of adults returning in the cycle year 4 years later, defining a utility curve for the catch, forecasting the number of salmon expected to return in the current year, and computing the escapement with the maximum expected utility. Discussion indicates areas where further work is needed and also other possible applications of the procedure. (Bell-Cornell) W79-03522

METHODS FOR EVALUATING NON-MARKET IMPACTS IN POLICY DECISIONS WITH SPECIAL REFERENCE TO WATER RESOURCES DEVELOPMENT PROJECTS, Maryland Univ., College Park. For primary bibliographic entry see Field 6B. W79-03525

RECENT DEVELOPMENTS IN THE MCLELLAN-KERR ARKANSAS RIVER NAVIGATION SYSTEM AREA,

Army Engineer Div., Southwestern Dallas, TX. For primary bibliographic entry see Field 4A. W79-03526

METHODS FOR ESTIMATING AND PROJECTING WATER DEMANDS FOR WATER-RESOURCES PLANNING,

California Univ., Riverside. For primary bibliographic entry see Field 6D. W79-03529

LEAST-COST DESIGN OF URBAN-DRAINAGE NETWORKS,

Washington Univ., Seattle. Dept. of Civil Engi-

neering. For primary bibliographic entry see Field 5C. W79-03531

LAND USE PLANNING, FLOOD CONTROL, Illinois Univ., Urbana-Champaign. For primary bibliographic entry see Field 5C. W79-03532

REGIONAL MODELS FOR LAND USE PLANNING, POLICY, Wisconsin Univ., Milwaukee. For primary bibliographic entry see Field 5C. W79-03533

Descriptors: \*Economic, \*Forecasting, \*Milwaukee, Two general models that the parameters of metric model extended enough to economy second hypothesis model have developed relationships and forecast model. The modifications Milwaukee model, maintained four sectors; employment for the disabilities at Great Milwaukee post forecast of the Local more accurate. From the aggregate, a success Philadelphia modeling. W79-03534

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ON THE NAMIC TIONS IN Arizona Univ., Water Resources. For primary bibliographic entry see Field 5C. W79-03535

A STUDY OF PARTIES SOURCE STATE: MENT SYSTEM, Washington. For primary bibliographic entry see Field 5C. W79-03536

CONTRIBUTION LOGICAL FOURTH,

## WATER RESOURCES PLANNING—Field 6

### Evaluation Process—Group 6B

neering.  
For primary bibliographic entry see Field 5D.  
W79-03533

#### LAND USE ALLOCATION MODEL FOR FLOOD CONTROL

Illinois Univ. at Urbana-Champaign. Inst. for Environmental Studies.  
For primary bibliographic entry see Field 4A.  
W79-03534

#### REGIONAL ECONOMETRIC FORECASTING MODELS: A TEST OF STRUCTURAL GENERALITY, DISAGGREGATION EFFECTS, AND POLICY ANALYSIS POTENTIALS.

Wisconsin Univ.-Madison. Dept. of Urban and Regional Planning.  
B. M. Rubin.

Available from University Microfilms International, Ann Arbor, MI 48106: Ph.D. Thesis, 1977. 255 p. 69 fig, 14 tab, 47 refs, 4 append. OWRT B-095-WIS(2) 14-34-0001-6133.

Descriptors: \*Alternative costs, \*Cost analysis, \*Econometrics, \*Economic impact, \*Estimating, \*Forecasting, \*Model studies, \*Wisconsin, \*Milwaukee(Wisc).

Two general hypotheses were posed. The first was that the prototype structure for small area econometric models developed by Glickman (1971) and extended by Hall and Licari (1973) is general enough to be utilized for the Milwaukee regional economy with only slight modifications. The second hypothesis was that a regional econometric model having greater disaggregation and a structure developed in accordance with theoretical relationships would produce more reliable simulation and forecasting results than the more aggregated model. The model was developed with minor modifications designed to provide a better fit to the Milwaukee regional economy. This aggregate model, as did the Philadelphia prototype, contained four manufacturing and non-manufacturing sectors; equations are presented for output, employment, and wages, and a series of relationships for the derivation of such regional aggregate variables as Gross Regional Product, total employment, unemployment rate, income, population, consumer prices, government revenues and government expenditures. The results of the ex post (sample period) forecasts, as measured by mean absolute percent error, indicated that this aggregate model generally succeeded in simulating values of the actual data to a degree superior to that of the Philadelphia prototype. A comparison of the ex post forecasts of the Milwaukee model with those of the Los Angeles model reveals that the former more accurately simulates regional business cycles. From the results, it can be concluded that the aggregate Milwaukee econometric model provides a successful test of the generality of Glickman's Philadelphia prototype for small area econometric modeling.  
W79-03593

#### ON THE THEORY AND MODELING OF DYNAMIC PROGRAMMING WITH APPLICATIONS IN RESERVOIR OPERATION,

Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.  
For primary bibliographic entry see Field 4A.  
W79-03671

#### A STUDY OF INTERESTED AND ACTIVE PARTIES CONCERNED WITH WATER RESOURCE MANAGEMENT IN WASHINGTON STATE: IMPLICATIONS FOR A MANAGEMENT SYSTEMS MODEL,

Washington State Univ., Pullman. Dept. of Political Science.

For primary bibliographic entry see Field 6B.  
W79-03693

#### CONTRIBUTED PAPERS ON COASTAL ECOLOGICAL CHARACTERIZATION STUDIES, FOURTH BIENNIAL INTERNATIONAL ES-

#### TUARINE RESEARCH FEDERATION CONFERENCE, OCTOBER, 1977.

Fish and Wildlife Service, Washington, DC. Office of Biological Services.  
For primary bibliographic entry see Field 2L.  
W79-03697

#### COASTAL ECOLOGICAL CHARACTERIZATION-AN OVERVIEW,

National Coastal Ecosystems Team, NSTL Station, MS.

For primary bibliographic entry see Field 2L.  
W79-03698

#### ECOSYSTEM CHARACTERIZATION-AN APPROACH TO COASTAL PLANNING AND MANAGEMENT,

Fish and Wildlife Service, Washington, DC. Office of Biological Services.

A. W. Palmisano.

In: Contributed Papers on Coastal Ecological Characterization, Fourth Biennial International Estuarine Research Federation Conference, October, 1977. U. S. Fish and Wildlife Service, Office of Biological Services, FWS/IBS-77/37, p 4-9, April, 1978. 4 fig.

Descriptors: \*Coasts, \*Ecosystems, \*Systems analysis, Coastal plains, Structural models, Estuaries, Structure, Ecology, Land management, Simulation analysis.

The ecosystem characterization approach involves the delineation of the physical boundaries of the system, preparation of a functional conceptual ecosystem model, synthesis and analysis of existing information using the model as a blueprint, and the preparation of an interim pilot characterization report. The latter report, after review by the user group, will permit the effective production of the final ecosystem characterization report. During the process most of the relevant information about the system will be brought together in a data source appendix. Guidance throughout the project is provided by the user committee to assure that the information will meet action program needs. Ecosystem characterizations can provide an important ecological foundation from which to plan and manage our natural resources. (See also W79-03697)(Steiner-Mass)  
W79-03699

#### EVALUATION OF METHODOLOGY USED IN ECOLOGICAL CHARACTERIZATION OF THE CHENIER PLAIN,

National Coastal Ecosystems Team, NSTL Station, MS.

For primary bibliographic entry see Field 6B.  
W79-03700

#### USER-ORIENTED CONCEPTUAL MODELING IN THE ECOLOGICAL CHARACTERIZATION OF THE SEA ISLANDS AND COASTAL PLAIN OF SOUTH CAROLINA AND GEORGIA,

South Carolina Wildlife and Marine Resources Dept., Charleston. Marine Resources Research Inst.

J. J. Manzi, and R. J. Reimold.

In: Contributed Papers on Coastal Ecological Characterization Studies, Fourth Biennial International Estuarine Research Federation Conference, October, 1977. U. S. Fish and Wildlife Service, Office of Biological Sciences, FWS/OBS-77/37, p. 19-31. 9 fig, 10 ref.

Descriptors: \*Model studies, \*Systems analysis, Estuaries, \*Design, Coasts, Coastal plains, Ecology, Ecosystems, Simulation analysis, Evaluation, Design, Testing, Analysis, Wetlands, Coastal marshes, Swamps, \*South Carolina, \*Georgia.

A user-oriented system of access is presented that produces information as well as an ecological understanding of the various habitats comprising the study area. The system is composed of four major parts: an executive summary, models, habitat distribution of various species, and interaction matrices. The executive summary will provide an introduc-

tion to characterization concepts, a brief summary of the ecosystems, and instructions for data search and retrieval. Models are included to present the principal components of each ecosystem and their relationships. The four models compiled for the test area are: the marine subtidal system, the estuarine intertidal emergent wetland system, the riverine forested wetland system, and the upland pine forest system. The models are presented in a diagrammatic (energese) and a pictorial mode. The ecological sketches are brief narratives on high priority species, and summarize their reproductive and cover requirements, and impinging human activities. Finally, the interaction matrices will form the central component of the user system package. Each ecosystem will be supported by a single matrix which cross-references common environmental alterations with existing environmental characteristics. Each intersection of the matrix will thus provide appropriate entry into the characterization products. (See also W79-03697) (Steiner-Mass)  
W79-03701

#### MAINE COAST CHARACTERIZATION USER'S GUIDE,

Energy Resources Co., Inc., Cambridge, MA.

For primary bibliographic entry see Field 2L.  
W79-03703

### 6B. Evaluation Process

#### ALLOCATIONAL INEFFICIENCY OF BENEFIT/COST APPLIED TO WATER AND SEWERAGE SUPPLY: INTERACTIONS BETWEEN TIME-SERIES AND CROSS-SECTIONAL MODELS,

Pennsylvania State Univ., University Park. Dept. of Economics.

S. P. Coelen, R. W. Bahl, and J. J. Warford.  
Water Supply and Management, Vol. 2, No. 3, p. 265-274, 1978. 1 fig, 3 tab, 11 ref, 13 ref.

Descriptors: \*Water supply, \*Sewerage, \*Cost-benefit analysis, \*Time series analysis, \*Measurement, Methodology, Data collections, Investment, Effects, Equations, Mathematical models, System analysis, Property values, Empirical analysis, Environmental analysis, Cross-section data, Developing countries.

A fundamental problem of cost-benefit analysis is that benefit measurement is often difficult or impossible. These difficulties vary considerably between sectors, and thus estimated economic rates of return may allocate funds inefficiently across the sectors. Within the sectors, water supply and sewerage projects fare badly due to systematic underestimation. The central premise of this analysis is that unpaid-for benefits from investments in public sewerage and water facilities are reflected in increased land values. The basic theory of this paper is taken from earlier work, especially from Lind (1974) and Rosen (1974), which is extended here to show that (1) the land value approach is particularly applicable in the developing countries, (2) time-series techniques are as useful for measuring land value increments as the more traditional cross-sectional methods, and (3) water/sewerage projects do, in fact, have an impact on property. Results obtained from using this modeling technique in a case study of Nairobi, Kenya are presented.  
W79-03520

#### METHODS FOR EVALUATING NON-MARKET IMPACTS IN POLICY DECISIONS WITH SPECIAL REFERENCE TO WATER RESOURCES DEVELOPMENT PROJECTS,

Maryland Univ., College Park.

K. Finsterbusch.

IWR Contract Report 77-8. U.S. Army Engineer Institute for Water Resources, Fort Belvoir, Virginia, December 1977. 46 p, 4 fig, 2 tab, 64 ref.

Descriptors: \*Water resources development, \*Projects, \*Evaluation, \*Non-market impacts, Decision making, Planning, Feasibility, Cost-benefit analy-

## Field 6—WATER RESOURCES PLANNING AND PROTECTION

### Group 6B—Evaluation Process

sis. Political aspects. River basins. Methodology. Water policy. Social impact. Comparative measurement. Goal programming. Weighting procedure. Systems analysis.

Explored is the as yet intractable problem of accounting for non-market impacts in policy decisions, especially in the context of water resource development projects. The first section presents and critiques in general terms 19 methods. Included are common metrics, weighting schemes, discrete dimensions evaluation, methods utilizing public or political evaluations, and methods which obviate evaluation. In the second section, the social impacts of water resource projects are reviewed and related to the 19 valuation methods. In the final section, a number of critical issues involved in valuing non-market impacts are discussed, considering: priority of social criteria over engineering-economic criteria; the principle of justice; selection versus elimination; the human limits to evaluations; and building cumulation into evaluations through rationalized weights. (Bell-Graf-Cornell)  
W79-03525

### CLIMATE, CLIMATIC CHANGE, AND WATER SUPPLY.

National Research Council, Washington, DC.  
For primary bibliographic entry see Field 2B.  
W79-03527

### WATER-RESOURCE SYSTEMS PLANNING.

Geological Survey, Reston, VA.

N. C. Matalas, and M. B. Fiering.

In: *Climate, Climatic Change, and Water Supply. Studies in Geophysics*, National Academy of Sciences, Washington, D.C., p. 99-110, 1977. (The National Research Council) 9 fig, 23 ref.

Descriptors: \*Water resources, \*Planning, \*Design, \*Climatic change, \*Economic regret, \*Robustness, Forecasting, Calculus, Hydrologic systems, Optimization, Systems analysis, Mathematical models, Probability, Uncertainty, Regret minimization.

Discussed is the calculus of economic regrets in water-resource design in light of possible procedural changes that could result from considering forecasts of climatic changes. It is emphasized that unless the exact sequence of future flows can be predicted with certainty, there may be little benefit to hydrologic system design of even an exact forecast of a change in one or more of the parameter values of the hydrologic input. To allow explicitly for climatic change in the design process, the concept of 'robustness' is introduced: A robust design may be optimal in the classical sense, but it will be a design which performs reasonably well under a variety of possible climates. The 'resilience' of an existing well-buffered water-resource system can be enhanced by changes in insurance, subsidies, zoning, water law, and price structures, as well as by additional structural measures, such as reservoirs or pipelines. Prolonged droughts could enhance conflicts between groups of water users. Referring to the Pareto frontier, it is hoped that resolution of such conflicts would be rational, with resulting tradeoffs acceptable to all. (See also W79-03527) (Bell-Graf-Cornell)  
W79-03528

### URBAN RUNOFF CONTROL MASTER PLANNING.

American Society of Civil Engineers, Marblehead, MA. Urban Water Resources Research Program. M. B. McPherson.

Journal of the Water Resources Planning and Management Division. Proceedings of American Society of Civil Engineers, Vol. 104, No. WR1, p. 223-234, November 1978. 4 fig, 49 ref.

Descriptors: \*Urban runoff, \*Planning, \*Land use, \*Flood control, \*Drainage, \*Water balance, \*Water pollution, \*Economic analysis, \*Models, Management, Costs, Cost-benefit analysis, Water resources, Control, Master plans, Public works, Systems analysis.

The thesis of this paper is that rational planning requires conjunctive consideration of the quantity and quality aspects of urban runoff within a comprehensive, multiple-use framework. Explored are some of the more obvious arguments with reference to land-use factors, economic evaluations, flood control considerations, performance simulation, and metropolitan water resource inventories. There appear to be very few master plans extant that have integrated water quantity management with water quality management. Given the institutional constraints in metropolitan areas, perhaps the most that can be expected is adoption of an integrated, comprehensive, or systems approach to urban runoff planning. However, such an approach is subtle in a documentary sense, and more rational conjunctive master planning may be in progress than external indications seem to imply. (Bell-Cornell)  
W79-03532

### DELAWARE RIVER BASIN WATER RESOURCES MANAGEMENT.

Delaware River Basin Commission, Trenton, NJ. C. H. J. Hull.

Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 104, No WR1, p 157-174, November 1978. 2 fig, 4 tab, 35 ref.

Descriptors: \*Delaware River, \*Flood control, \*Water resources, \*Water supply, \*Water management (Applied), \*Salinity, Planning, Estuaries, Water quality, Rivers, Water pollution, Multiple purpose. Delaware River Basin Commission, Tocks Island Lake project.

The Comprehensive Plan (CP) for multipurpose development and management of water resources in the Delaware River Basin, under the first Federal-Interstate compact, is explained. The CP is a codification of administrative laws adopted by the Delaware River Basin Commission, and serves as a general guide for planning, development, and operation of water-related projects and facilities, both public and private, for water supply, water quality control, flood control, hydroelectric power generation, and recreation. The CP serves also a regulatory document to prohibit developments that do not conform to the adopted plan. The CP grows in scope almost monthly as the Commission adds new projects, policies, criteria, and standards. The CP, together with the basic statutory law, the Delaware River Basin Compact, provide the legal basis for regulatory control of water resources in the four-state, 13,000 square mile region. The CP includes the controversial Tocks Island Lake project, a multipurpose impoundment sited on a 37-mile reach of the Delaware River just downstream of the New York-New Jersey state boundary, which has been halted by opposition from environmental groups. (Bell-Cornell)  
W79-03538

### PUBLIC PROCESS PORTION OF IMPACTS ANALYSIS,

Parsons, Brinckerhoff, Quade and Douglas, Inc., Vienna, VA.

For primary bibliographic entry see Field 6G.  
W79-03539

### REGIONAL ECONOMETRIC FORECASTING MODELS: A TEST OF STRUCTURAL GENERALITY, DISAGGREGATION EFFECTS, AND POLICY ANALYSIS POTENTIALS,

Wisconsin Univ.-Madison. Dept. of Urban and Regional Planning.

For primary bibliographic entry see Field 6A.  
W79-03593

### URBAN WATER RESOURCES POLICY ALTERNATIVES: A SOCIOLOGICAL ANALYSIS OF DIFFERENTIAL PERSPECTIVES,

Purdue Univ., Lafayette, IN. Dept. of Sociology and Anthropology.

H. R. Potter, A. K. Taylor, and G. M. Grossman. Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 583.  
W79-03664

Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center, Purdue University Technical Report No. 106, December 1978. 35 p, 23 tab, 2 ref, 1 append. OWRT C-6106 (5213)(7).

Descriptors: \*Water Resources Development, \*Urban drainage, \*Floodplains, \*Ditches, \*Social participation, Canals, Conduits, Pipes, Sewers, Subsurface drains, Attitudes, Urban sociology, Institutions, \*Urban Water Resources, \*Retention basins, \*Public participation.

The purpose was to examine the acceptability to community leaders and the general public of selected urban water resources policy alternatives. The orientation is methodological; using the survey method, questions are deliberately varied in generality-specificity, and comparisons are made on the effect of experience with water problems and location of residence (urban, transitional, rural) on acceptability of alternative solutions. Data are from personal interviews with 46 leaders and a sample of 139 other residents of Tippecanoe County, Indiana. Asking more specific questions produced greater indications of concern with the environment and water pollution. Many of the differences between leaders and nonleaders were small; however, some important differences were found. For example, although leaders view themselves as more conservative, they were more liberal on some policy issues, e.g., willingness to pay more to combat water pollution and a firm policy to prevent building in wetlands. Only limited differences were found across residential location, with wetlands policy being a specific example of a substantial difference. Respondents expressed considerable concern over two drainage alternatives, retention basins and open ditches, whether they had direct experience with them or not. They also expressed a strong belief in citizen participation and a preference for local government involvement in policy decisions.  
W79-03660

### INTERREGIONAL IMPACTS OF ALTERNATIVE WATER POLICIES FOR IRRIGATION IN THE WESTERN UNITED STATES: A QUANTITATIVE ASSESSMENT,

Wisconsin Univ.-Madison. Dept. of Agricultural Economics.

N. L. Meyer.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 667, Price codes: A10 in paper copy, A01 in microfiche. Ph.D. Thesis, 1974. 191 p, 10 fig, 15 tab, 57 ref, 3 append. OWRT B-057-WIS(5), 14-31-0001-3354.

Descriptors: \*Regional economics, \*Regional development, Water resources development, \*Water distribution, \*Farm management, \*Crop production, \*Sweet potatoes, \*Transportation, \*Alternative planning, \*Water policy.

An evaluation framework was developed which permits measuring the interregional effects that would result from water resource projects in the West. Further, the framework facilitates identification of intraregional shifts associated with project-induced interregional impacts. Impacts of four water policies were considered. Alternative water policies are: (1) continue present policy, (2) cease new construction and honor existing contracts on present projects, (3) build new water projects only if they can repay the cost of delivering water for both new and existing projects. Each policy change was evaluated by region with respect to changes in acreage, total revenue, farm revenue, processing revenue, and transportation revenue. Aggregate changes in farm, processing and transportation revenues were also shown. Fall potatoes were used as a vehicle for the analysis. Continuing present water policy would encourage expansion of acreage in areas utilizing subsidized water. Production would remain constant or decline in higher cost production areas. Continuing present pricing policies on existing projects and ceasing construction of new projects implies expanded production would have to be through technical change in water use or through increased acreage in regions not dependent on publicly subsidized water.

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## Evaluation Process—Group 6B

**SUBJECTIVE ESTIMATION OF VARIABILITY,**  
Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.

R. L. Fike.  
Available from the National Technical Information Service, Springfield, VA, 22161 as PB-290 680, Price codes: A08 in paper copy, A01 in microfiche. Ph.D. Dissertation, 1977. 147p, 14 fig, 14 tab, bibliography, 3 append. OWRT B-043-ARIZ(26), 14-31-0001-5056.

Descriptors: \*Attitudes, \*Human behavior, Estimating, \*Human perception, \*Variability. \*Estimate combination, Sample information.

Experimental research concerning perception and estimation of variability and the combination of variability estimates is reported. People's ability to perceive variability, as shown by their ability to make correct discrimination judgments among small visually presented samples drawn from populations with the same mean but with different variances, is nearly optimal. Experiments are reported which show that people are able to encode their perception of variability into quantitative estimates which are fairly accurate. The commonly reported 'hypercertainty' phenomenon, extreme overconfidence of underestimation of the variability, is found to be associated primarily with a complete lack of sample information on which the estimates can be based (e.g., almanac-type variables). A model of human performance, which is substantially different from the mathematically correct one, is proposed for tasks involving estimation of composite variability based on data about the component variables. It is concluded that, contrary to the indications of prior work, people are potentially able to perceive and estimate variability fairly accurately, especially if they have even a small amount of sample information.

W79-03665

**PUBLIC PARTICIPATION IN 208 WATER QUALITY PLANNING: A CASE STUDY OF TRIANGLE J COUNCIL OF GOVERNMENT, NORTH CAROLINA,**

North Carolina Univ. at Chapel Hill. Dept. of City and Regional Planning; and North Carolina Univ. at Chapel Hill. Center for Urban and Regional Studies.

For primary bibliographic entry see Field 5G. W79-03666

**RESEARCH ON MINNESOTA WATER PROBLEMS.**

Minnesota Univ., St. Paul. Water Resources Research Center.

For primary bibliographic entry see Field 9A. W79-03674

**WATER RESOURCE STANDARDS FOR SECOND HOME AND RECREATIONAL LAND DEVELOPMENT.**

North Carolina Univ. at Chapel Hill. Center for Urban and Regional Studies.

For primary bibliographic entry see Field 5G. W79-03675

**COMBATING PHEASANT LOSSES IN THE COLUMBIA BASIN - WHERE DO WE GO FROM HERE.**

Washington State Univ., Pullman. Dept. of Agricultural Economics.

S. C. Matulich, and B. F. Wolfley.  
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 608, Price codes: A02 in paper copy, A01 in microfiche. OWRT C-7165 (No. 6213)(3), 14-31-0001-6213.

Descriptors: \*Irrigation projects, \*Washington, \*Pheasants, Recreation, Planning, \*Columbia River Basin(Wash), Economic analysis, Cost analysis, \*Income.

In the absence of apparent legal obligations which bind existing Columbia Basin irrigators to deliberately allocate resources toward pheasant produc-

tion, provision of economic incentives is necessary to change the status of pheasant from an unintentional production alternative. The amount and type of resources farmers will voluntarily divert from cropping activities depends upon the economic incentives for wildlife production relative to other production possibilities. In the context of non-market goods such as pheasant (which are not bought and sold in the market place), incentives must equal or exceed the opportunity cost of their production. That is, incentives (compensation) required to shift resources to pheasant production must be at least equal to the income foregone from crop production. Provision of such incentives is justified if the benefits from additional pheasant equal or exceed the foregone farm income.

W79-03686

**PHEASANT ENHANCEMENT POTENTIALS IN IRRIGATED AGRICULTURE: A CASE STUDY OF THE COLUMBIA BASIN,**

Washington State Univ., Pullman. Dept. of Agricultural Economics.

G. H. Bagwell.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 556, Price codes: A06 in paper copy, A01 in microfiche. MA Thesis, 1978. 104 p, 14 tab, 37 ref, 4 append. OWRT C-7165 (No 6213)(4), 14-31-0001-6213.

Descriptors: \*Pheasants, Irrigated agriculture, Wildlife managers, \*Washington, \*Columbia River basin(Wash), Management, Economic feasibility, Alternative costs.

Declining pheasant populations within irrigated agriculture have alarmed wildlife managers who began identifying methods of stabilizing and enhancing the pheasant population. The fundamental problem is that of allocating scarce resources between agriculture and wildlife. The overall objective of this study was to determine the opportunity costs of alternative pheasant enhancement practices, and to examine their potential economic feasibility within irrigated agriculture. Typical Columbia Basin farm operations were modeled into enterprise base budgets. Wheal farm costs and returns were estimated when enterprise budgets were aggregated by rotation to the farm level. Comparison of foregone income with pheasant response estimates provided an opportunity cost per bird. Analysis of alternative pheasant enhancement practices revealed a large deviation in opportunity costs per bird. Permanent cover crops in the form of strips and small-sized farms were found to provide least-cost enhancement. Generally, enhancement practices which generate large pheasant responses were associated with substantially higher per pheasant opportunity costs than low bird response enhancement practices. Comparison of the least cost enhancement practices with current Game Department costs of pen raising and releasing pheasants, and in consideration of additional values gained from establishing permanent habitat, pheasant enhancement in irrigated agriculture appears potentially feasible. Successful enhancement, however, is contingent upon farmers being compensated for lost income. Wildlife managers should direct enhancement strategies toward lower valued crops and small farms liberalization of hunting regulations in enhanced areas; public access to enhanced areas must be assured.

W79-03687

**A STUDY OF INTERESTED AND ACTIVE PARTIES CONCERNED WITH WATER RESOURCE MANAGEMENT IN WASHINGTON STATE: IMPLICATIONS FOR A MANAGEMENT SYSTEMS MODEL,**

Washington State Univ., Pullman. Dept. of Political Science.

B. A. Haines.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 665, Price codes: A07 in paper copy, A01 in microfiche. Masters Thesis, 1978. 133 p, 3 fig, 17 tab, 24 ref, 9 append. OWRT A-090-WASH(2).

Descriptors: \*Administration, \*Management, \*Washington, \*Planning, \*Water resources, Deci-

sion making, Water resources development, Water conservation, Water policy, Water utilization, State governments, Regional development, Human population, Systems analysis.

In response to a legislative mandate calling for public participation in water resource management in Washington State, a hypothetical management model was developed. The background of current policy decisions includes past and present statutory law, administrative regulations, and literature on the concept of beneficial use of water. Major factors considered in developing this model included: the present tax payer revolt seeking a reduction in government spending; increasing pressure for new uses/users of this resource which has finite, but unpredictable, limits; and pressures from different users to establish theirs as the most important use. A management system utilizing non-governmental entities to develop and administer programs directed toward conservation, especially reducing waste, would address these problems. The management system is described and accompanied by a flow chart of its physical structure. To determine the potential usefulness of this model, data derived from questionnaire responses of governmental and non-governmental people interested and involved in water resources administration were used. The population study and its findings are reported. Conclusions relating to the validity of the model and further research recommendations are presented. (Davison-IPA) W79-03693

**AN ECONOMIC ANALYSIS OF PRICING RESIDENTIAL WATER SUPPLIES IN PUERTO RICO,**

Puerto Rico Univ., Mayaguez. School of Engineering.

R. Ramgolam, and H. Sahai.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 564, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Research Institute, University of Puerto Rico, Completion Report December 1977. 122 p, 5 fig, 16 tab, 26 ref. OWRT A-047-PR(1).

Descriptors: \*Water allocation(Policy), \*Puerto, \*Water rates, \*Cost analysis, Discriminatory pricing, Water users, Water loss, Puerto Rico Aqueduct and Sewer Authority, Domestic water, Water policy.

A study of water pricing in Puerto Rico was conducted: (1) to examine the application of price theory in the allotment of residential water; (2) to determine which factors affect the price of water used in the residential areas; (3) to investigate and evaluate the existing price structure and pricing policy of residential water; and (4) examine water pricing policies based on economic criteria and provide recommendations for efficient water allocation to Puerto Rican residents. The Puerto Rico Aqueduct and Sewer Authority (PRASA) is a monopoly and a semi-autonomous agency of the Puerto Rican government which provides residential water service to all of Puerto Rico. Present rates are metered, based on a five block schedule applicable to all customer classes; the rates increase in the first two blocks and then decline. The rates were found discriminatory because of a higher charge to residential customers, with the highest charge to the middle class. A regression analysis indicated the following four variables significant in determining water rates: (1) number of customers served, (2) water loss, (3) net debt, and (4) government subsidies. It is recommended that charges for water service be equal to marginal production costs supplemented by a service charge equal to the difference between the average and marginal production costs. (Davison-IPA) W79-03694

**MOTORBOAT USE ON THE WILD ROGUE RIVER: AN INVESTIGATION OF USE BETWEEN WATSON CREEK AND BLOSSOM BAR,**

Oregon State Univ., Corvallis. Dept. of Geography.

For primary bibliographic entry see Field 5B.

## Field 6—WATER RESOURCES PLANNING

### Group 6B—Evaluation Process

W79-03695

#### EVALUATION OF METHODOLOGY USED IN ECOLOGICAL CHARACTERIZATION OF THE CHENIER PLAIN,

National Coastal Ecosystems Team, NSTL Station, MS.  
R. H. Chabreck, J. B. Johnston, and J. B. Kirkwood.

In: Contributed Papers on Coastal Ecological Characterization Studies, Fourth Biennial International Estuarine Research Federation Conference October, 1977. U. S. Fish and Wildlife Service, Office of Biological Services, FWS/OBS-77/37, p. 10-14, April, 1978. 3 tab.

Descriptors: \*Evaluation, \*Systems analysis, \*Ecosystems, \*Coasts, Coastal plains, Ecology, Land management, Simulation analysis, Design, Testing, Analysis.

The Chenier Plain, Texas-Louisiana, ecosystem characterization was the first investigation of this type to be initiated so that an important aspect of the project was an evaluation of the methodology used. This evaluation was needed also for the orderly execution of subsequent characterizations of other coastal ecosystems. A methodology evaluation made it possible to identify techniques which effectively served to meet project objectives, and at the same time it identified procedures that had not contributed significantly. Aspects of the characterization methodology evaluated include the steering committee concept, user needs survey, conceptual modeling, area delineation, type of mapping, data search and presentations and pilot study. The results of the evaluations are given and the paper suggests alternative procedures where unsatisfactory results were obtained. (See also W79-03697) (Steiner-Mass)  
W79-03700

#### MANAGEMENT OF SALINE WATER,

California Univ., Davis. Dept. of Agricultural Economics.

C. V. Moore, and J. H. Snyder.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 784, Price codes: A03 in paper copy, A01 in microfiche. Report No. 29, Water Resources Center, Univ of Calif, Davis, Mar 1974. 20 p, 6 fig. (California Water Resources Center Project UCAL-WRC-W-244). OWRT B-147-CAL(2), B-136-CAL(3), B-120-CAL(4), B-094-CAL(5).

Descriptors: \*Economics, \*Management, \*Saline water, \*Colorado River basin, \*Salinity, Mexico, International waters, Withdrawal, \*Irrigation efficiency, \*California, \*Imperial Valley(Calif), \*Orange County(Calif), \*Salton Sea(Calif).

Recent research on the economics of saline water management was surveyed and principal conclusions summarized. Salinity studies in the Colorado River Basin, Imperial Valley, Orange County (California), and Salton Sea were examined. Effects of agriculture on quantity and quality of water, methods of increasing irrigation efficiency, salinity in urban and recreational water uses, international and legal aspects of salinity, and cost-sharing in salinity control are discussed. Salinity in a river basin tends to increase from the headwaters to the mouth. The saline waters of the Colorado River pose major management problems in the regions studied, and are also important in relations with Mexico. Total water withdrawals exceed annual replenishments, and total dissolved salinity in the lower reaches of the river are near or beyond threshold uses. Estimated economic losses to domestic users are about \$16 million and are projected to increase to a possible level of about \$28 million by 1980.  
W79-03774

### 6C. Cost Allocation, Cost Sharing, Pricing/Repayment

OUTLOOK FOR ENERGY AND IMPLICATIONS FOR IRRIGATED AGRICULTURE, Texas A and M Univ., College Station. Dept. of Agricultural Economics and Rural Sociology. For primary bibliographic entry see Field 3F.  
W79-03667

ECONOMIC ANALYSIS OF CHLOROFORM REMOVAL FROM DRINKING WATER, Maryland Univ., College Park. Bureau of Business and Economic Research.

For primary bibliographic entry see Field 5F.  
W79-03680

#### AN ECONOMIC ANALYSIS OF PRICING RESIDENTIAL WATER SUPPLIES IN PUERTO RICO,

Puerto Rico Univ., Mayaguez. School of Engineering.

For primary bibliographic entry see Field 6B.  
W79-03694

### 6D. Water Demand

#### INSTREAM FLOW-APPLICABILITY OF EXISTING METHODOLOGIES FOR ALASKAN WATERS,

Woodward-Clyde Consultants, Anchorage, AL.

For primary bibliographic entry see Field 4A.  
W79-03517

#### METHODS FOR ESTIMATING AND PROJECTING WATER DEMANDS FOR WATER-RESOURCES PLANNING,

California Univ., Riverside.

E. M. Lofting, and H. C. Davis.

In: Climate, Climatic Change, and Water Supply. Studies in Geophysics, National Academy of Sciences, Washington, D.C., p. 49-69, 1977. 11 fig, 14 tab, 70 ref.

Descriptors: \*Water resources, \*Long-term planning, \*Water demand, \*Forecasting, \*Economic uncertainty, Estimating, Effects, Water utilization, Water requirements, Annual, Land use, Mathematical models, Systems analysis, Linear programming, Climatic variability, Water withdrawal.

Considered are the problems of estimating and forecasting water demands or requirements for the water-use categories of irrigation, commercial, municipal (residential), minerals industries, manufacturing industries, and thermoelectric power. Noted are three new sources of economic uncertainty which make forecasts of future water demand particularly problematic: (1) the enactment of Public Law 22-500; (2) a large increase in irrigated agriculture; and (3) the threat of climatic change. Water-resource systems planning and the role of water-use data in the development of water-use forecasts are discussed. Considered is the interregional linear programming model developed by Heady which yields the least-cost distribution of agricultural production by crop type and geographic region. Next the possible impacts of climatic variability are discussed. The paper concludes with a graphical comparison of existing water-use forecasts to the years 2000-2020, with the results of a simple forecasting model constructed by the authors. (See also W79-03527) (Bell-Cornell)  
W79-03529

#### POWER DEVELOPMENT AND WATER ALLOCATION IN OHIO RIVER BASIN,

Illinois Univ. at Urbana Champaign. Dept. of Civil Engineering.

For primary bibliographic entry see Field 4A.  
W79-03537

### 6E. Water Law and Institutions

CALIFORNIA CHANGES ITS ENVIRONMENTAL QUALITY ACT, California Resources Agency, Sacramento. For primary bibliographic entry see Field 5G.  
W79-03535

ENGINEERING SOLUTIONS TO BAY AREA DROUGHT CONDITIONS, East Bay Municipal Utility District, Oakland, CA. For primary bibliographic entry see Field 4A.  
W79-03536

A STUDY OF INTERESTED AND ACTIVE PARTIES CONCERNED WITH WATER RESOURCE MANAGEMENT IN WASHINGTON STATE: IMPLICATIONS FOR A MANAGEMENT SYSTEMS MODEL, Washington State Univ., Pullman. Dept. of Political Science.

For primary bibliographic entry see Field 6B.  
W79-03693

#### ENVIRONMENTAL QUALITY, THE MARKET, AND PUBLIC FINANCE,

Clemson Univ., S. C. Water Resources Research Inst.

For primary bibliographic entry see Field 6G.  
W79-03768

FEDERAL COMPLIANCE WITH STATE POLLUTION CONTROL REQUIREMENTS - CALIFORNIA V. ENVIRONMENTAL PROTECTION AGENCY, 511 F. 2D 963 (9TH CIR. 1975), Wyoming Univ., Laramie. Coll. of Law.  
B. J. Trautwein.

Land and Water Law Review, Vol. XI, No. 1, p. 147-157, 1976. OWRT-A-003-WYO(5), 14-31-0001-5051.

Descriptors: \*Water law, Water pollution control, Water right, Federal Water Pollution Control Act, Jurisdiction.

This case note addresses the subject whether federal installations and agencies must comply with state substantive and procedural requirements with respect to water pollution. The court in deciding the case addressed the issues whether Congress waived exclusive jurisdiction over water pollution in a manner that was not unduly broad and whether the waiver was made in a clear and unequivocal manner. The court reached the decision that the 1972 Federal Water Pollution Control Act mandated federal compliance with state procedural requirements respecting water pollution control. The rationale for this result was that the 1972 Act gave the states the right to regulate water pollution by a permit system and that federal compliance with the permit system was the only effective method insuring federal compliance with substantive state water pollution standards.  
W79-03770

#### AN ECONOMIC METHODOLOGY FOR EVALUATING 'BEST MANAGEMENT PRACTICES' IN THE SAN JOAQUIN VALLEY OF CALIFORNIA,

Economics, Statistics, and Cooperatives Service, Washington, DC.

For primary bibliographic entry see Field 5G.  
W79-03958

### 6F. Nonstructural Alternatives

#### LAND USE ALLOCATION MODEL FOR FLOOD CONTROL,

Illinois Univ. at Urbana-Champaign. Inst. for Environmental Studies.

For primary bibliographic entry see Field 4A.  
W79-03534

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### 6G. Economics

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## WATER RESOURCES PLANNING—Field 6

### Ecologic Impact Of Water Development—Group 6G

#### POLICIES FOR MINIMIZING FLOOD HAZARDS,

Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.

L. A. Shabman.

Virginia Agricultural Economics No 260 p1-3, July 1974. OWRT-A-054-VA(1).

Descriptors: \*Flood control, \*Flood hazards, Water policy, \*Flood damage, Floods, \*Flood plain management.

A popularized discussion of the flood damage problem is presented. Included are definitions of flood hazard, identification of alternatives for flood hazard reduction, and consideration of issues in developing a policy toward flooding.

W79-03590

#### URBAN WATER RESOURCES POLICY ALTERNATIVES: A SOCIOLOGICAL ANALYSIS OF DIFFERENTIAL PERSPECTIVES,

Purdue Univ., Lafayette, IN. Dept. of Sociology and Anthropology.

For primary bibliographic entry see Field 6B.

W79-03660

#### NWS'S FLASH FLOOD WARNING AND DISASTER PREPAREDNESS PROGRAMS,

National Weather Service, Silver Spring, MD. Disaster Preparedness Staff.

H. M. Mogil, J. C. Monroe, and H. S. Groper.

Bulletin of the American Meteorological Society, Vol 59, No 6, p 690-699, June 1978. 8 fig, 53 ref.

Descriptors: \*Flash floods, \*Warning systems, \*Forecasting, \*Planning, Disasters, Floods, Excessive precipitation, Precipitation(Atmospheric), Rainfall, Thunderstorms, Tropical storms, Hazards, Flood plains, Radar, Communication, Weather, Meteorology.

Flash floods have become the nation's number one stormy weather killer in the 1970s. Deaths from flash floods are now approaching 200 each year compared to an average of less than 70 per year during the preceding 30-year period. Losses from flash floods are now nearly 10 times what they were in the 1940s. To combat these escalating losses, the National Weather Service (NWS) is expanding its efforts to improve forecasting and warning of flash floods and to improve the public's response to flash flood threats. This paper summarized the present and planned NWS operational flash flood warning and disaster preparedness programs. (Sims-ISWS)

W79-03816

## 6G. Ecologic Impact Of Water Development

#### INSTREAM FLOW-APPLICABILITY OF EXISTING METHODOLOGIES FOR ALASKAN WATERS,

Woodward-Clyde Consultants, Anchorage, AL.

For primary bibliographic entry see Field 4A.

W79-03517

#### ENVIRONMENTAL SPECIALISTS IN WATER AGENCIES,

Stanford Univ., CA. Dept. of Civil Engineering. B. R. Jenkins, and L. Ortolland.

Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. WRI, p. 61-74, November 1978. 1 fig, 1 tab.

Descriptors: \*Water resources, \*Management, \*Government agencies, \*Personnel, \*Environmental impact statements, Civil engineers, Organization theory, Reports, Water plans.

There are five different roles that environmental specialists can play in water resource agencies: (1) environmental planning; (2) environmental design; (3) system monitoring; (4) report preparation; and (5) report review. Placement of environmental spe-

cialists in 'line units' (e.g., planning, design, and maintenance) facilitates coordination. There are, however, significant advantages, in terms of report preparation and review, of keeping environmental specialists in one organization unit and not diffusing them into various units. But with a separate 'staff unit' for environmental specialists, these specialists have less influence on planning and decision making. Numerous aspects of this dilemma are explored using data for the Santa Clara Valley Water District in California and several District Offices of the U.S. Army Corps of Engineers. In the final analysis, the organization arrangement that is in some sense best depends on which of the several roles played by the environmental specialists is to receive emphasis. (Bell-Cornell)

W79-03531

#### CALIFORNIA CHANGES ITS ENVIRONMENTAL QUALITY ACT,

California Resources Agency, Sacramento.

For primary bibliographic entry see Field 5G.

W79-03535

#### PUBLIC PROCESS PORTION OF IMPACTS ANALYSIS,

Parsons, Brinckerhoff, Quade and Douglas, Inc., Vienna, VA.

F. W. Montanari.

Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 104, No WRI, p 123-128, November 1978. 2 fig.

Descriptors: \*Water resources, \*Management, \*Social participation, \*Environmental impact statements, Water plans, Projects, NEPA, Public process, Anatomy of delay.

With over 8 years of experience with NEPA and public participation in environmental analysis, there is a need to evaluate the cost of the process as compared with the benefits achieved in the actual projects. Frequently, opponents to the actions have sought only to destroy the projects, not to contribute to providing needed services to society. The implications of the public portion of the environmental planning and management with and without public participation are described. An anatomy of delay cites an actual case history of extreme frustration and costly delay in clearing a needed, well-planned, and environmentally-sound project. A post audit to evaluate the results of the process to make NEPA operate efficiently is recommended. (Bell-Cornell)

W79-03539

#### THE CIVIL ENGINEER'S RESPONSIBILITY IN IMPACT ANALYSIS,

American Society of Civil Engineers, New York. Committee on Impact Analysis of the Water Resources Planning.

Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 104, No WRI, p 253-263, November 1978. 6 ref, 8 append.

Descriptors: \*Environmental effects, \*Water resources, \*Environmental factors, \*Environmental impact statements, Natural resources, Planning.

Ways are suggested for engineers and others to make environmental impact analysis more effective by giving specific consideration to the following points: incorporating the analysis as an integral part of the total planning process; recognizing risks in the analysis and decisions; focusing on important issues; recognizing and accounting for the reliability of information; pursuing levels of detail in the analysis consistent with levels in other parts of the planning process and with the importance of the respective issues; making costs of the analysis consistent with other planning costs; and expressing criteria for selection of professional experts and for dealing with nonexpert opinion (insofar as possible) eliminating inconsistency of evaluation procedures among various water programs, with the engineer assuming an appropriate role in the public arena, combining EIS with other required environmental spe-

documents, and taking adequate time for the analysis. (Bell-Cornell)

W79-03541

#### AQUATIC AND TERRESTRIAL SURVEYS IN THE VICINITY OF POWER PLANTS USING REMOTE SENSING,

Calspan Corp, Buffalo, NY.

For primary bibliographic entry see Field 5A.

W79-03567

#### CONTRIBUTED PAPERS ON COASTAL ECOLOGICAL CHARACTERIZATION STUDIES, FOURTH BIENNIAL INTERNATIONAL ESTUARINE RESEARCH FEDERATION CONFERENCE, OCTOBER, 1977.

Fish and Wildlife Service, Washington, DC. Office of Biological Services.

For primary bibliographic entry see Field 2L.

W79-03697

#### COASTAL ECOLOGICAL CHARACTERIZATION—AN OVERVIEW,

National Coastal Ecosystems Team, NSTL Station, MS.

For primary bibliographic entry see Field 2L.

W79-03698

#### USER-ORIENTED CONCEPTUAL MODELING IN THE ECOLOGICAL CHARACTERIZATION OF THE SEA ISLANDS AND COASTAL PLAIN OF SOUTH CAROLINA AND GEORGIA,

South Carolina Wildlife and Marine Resources Dept., Charleston. Marine Resources Research Inst.

For primary bibliographic entry see Field 6A.

W79-03701

#### IMPORTANCE OF RIPARIAN ECOSYSTEMS: BIOTIC CONSIDERATIONS,

New Mexico Dept. of Game and Fish, Santa Fe.

For primary bibliographic entry see Field 21.

W79-03706

#### IMPORTANCE OF RIPARIAN ECOSYSTEMS: ECONOMIC CONSIDERATIONS,

Arizona Water Commission, Phoenix.

K. Fox.

In: Importance, Preservation and Management of Riparian Habitat: A Symposium, July 9, 1977, Tucson, Arizona. USDA Forest Service General Technical Report RM-43 p. 19-22.

Descriptors: \*Riparian land, \*Economics, \*Vegetation, Forests, Recreation, Agriculture, Flood control, Water yield improvement, Effects, Wetlands, Habitats.

Most clearing of the riparian zone today consists of clearing phreatophytes along the Colorado River below the Davis Dam. Such land is cleared for agricultural purposes, the development of subdivisions, and water yield improvement and flood damage reduction projects. Recreational use is also a threat to riparian habitats. (Stihler-Mass)

W79-03707

#### A RIPARIAN CASE HISTORY: THE COLORADO RIVER,

Arizona State Univ., Tempe. Dept. of Zoology, and Arizona State Univ., Tempe. Center for Environmental Studies.

R. D. Ohmart, W. O. Deason, and C. Burke.

In: Importance, Preservation and Management of Riparian Habitat: A Symposium, July 9, 1977, Tucson, Arizona. USDA Forest Service General Technical Report RM-43 p. 35-47. 1 fig, 38 ref.

Descriptors: \*Riparian land, \*Riparian plants, \*Cottonwoods, \*Colorado River, Southwest U.S. Trees, Vegetation, Birds, Habitats, Dams, Agriculture, Wetlands, Rivers.

Historically to present cottonwood communities have declined in abundance along the lower Colo-

## Field 6—WATER RESOURCES PLANNING

### Group 6G—Ecologic Impact Of Water Development

rado River to the condition that the future of this natural resource is precarious. Avian species showing strong specialization to cottonwood communities may be extirpated should the cottonwood community be lost from the river. Only through the concern and action by responsible can we assure the persistence of this natural resource. (Stihler-Mass)  
W79-03709

**WILDLIFE CONFLICTS IN RIPARIAN MANAGEMENT: GRAZING.**  
Coronado National Forest, Tucson, AZ.  
For primary bibliographic entry see Field 4C.  
W79-03710

**WILDLIFE CONFLICTS IN RIPARIAN MANAGEMENT: WATER,**  
Forest Service, Albuquerque, NM.

C. E. Kennedy.  
In: Importance, Preservation and Management of Riparian Habitat: A Symposium, July 9, 1977, Tucson, Arizona, USDA Forest Service General Technical Report RM-43, p. 52-58. 4 fig, 33 ref.

Descriptors: \*Riparian land, \*Grazing, \*Trees, Effects, Livestock, Southwest U.S., Arizona, New Mexico, Wetlands.

Many streams in Arizona and New Mexico are dependent upon the riparian zone and their associated wetlands for their primary energy source. Continued grazing has eliminated riparian trees in many areas. When this occurs, streams are less confined to their banks and have a more constant sediment load. Fencing out livestock may reduce such damage. (Stihler-Mass)  
W79-03711

**MANAGEMENT ALTERNATIVES FOR RIPARIAN HABITAT IN THE SOUTHWEST,**  
Apache-Sitgreaves National Forest, Springerville, AZ.

G. A. Davis.  
In: Importance, Preservation and Management of Riparian Habitat: A Symposium, July 9, 1977, Tucson, Arizona, USDA Forest Service General Technical Report RM-43, p. 59-67. 19 ref.

Descriptors: \*Riparian land, \*Riparian plants, \*Management, Southwest U.S., Ecology, Grazing, Livestock, Evaluation, Trees, Vegetation, Streams, Wetlands.

Riparian habitats may fail to regenerate themselves because of: loss of water flow as a result of diversion, loss of significant portions of entire communities due to floods, high recreational use, phreatophyte control projects, or overgrazing by livestock. A 100-point transect technique for riparian stand analysis is described. Stand composition, crown density, basal area, vigor, and stand structure are taken into account. Management alternatives and objectives are evaluated for environmental consequences. (Stihler-Mass)  
W79-03712

**ENDANGERED SPECIES VS. ENDANGERED HABITATS: A CONCEPT,**  
Grand Canyon National Park, AZ.

R. R. Johnson, L. T. Haight, and J. M. Simpson.  
In: Importance, Preservation and Management of Riparian Habitat: A Symposium, July 9, 1977, Tucson, Arizona, USDA Forest Service General Technical Report RM-43, p. 68-79. 3 tab, 81 ref.

Descriptors: \*Riparian land, \*Habitats, \*Birds, Wetlands, Streams, Dams, Legal aspects, Wildlife, Management, Southwest U.S., Endangered species.

The highest densities of nesting birds in North America have been reported from Southwest riparian forests. Complete loss of riverine habitat in the Southwest lowlands could result in extirpation of 47 percent of the 166 species of birds which nest in this region. (Stihler-Mass)  
W79-03713

**RIPARIAN RESEARCH NEEDS,**  
Rocky Mountain Forest and Range Experiment Station, Tempe, AZ.  
D. R. Patton.

In: Importance, Preservation and Management of Riparian Habitat: A Symposium, July 9, 1977, Tucson, Arizona, USDA Forest Service General Technical Report RM-43, p. 80-82. 2 fig, 3 ref.

Descriptors: \*Riparian land, \*Research priorities, \*Southwest U.S., Wetlands, Vegetation, Trees, Wildlife, Ecology, Maps, Classification, Riparian plants, Management.

Approximately 22 studies on riparian are in progress in the western United States. Six categories of studies are needed to provide managers with data for making decision. These are: inventories and maps, vegetation classification, plant-animal associations, influence of man and nature, silvics of tree species and life history of vertebrate species. The concept of 'validation sites' can be used in a team approach to solve plant and animal problems. (Stihler-Mass)  
W79-03714

**AN OVERVIEW OF RIPARIAN FORESTS IN CALIFORNIA: THEIR ECOLOGY AND CONSERVATION,**  
California Univ., Davis, Inst. of Ecology.

For primary bibliographic entry see Field 2I.  
W79-03716

**REGENERATION AND DISTRIBUTION OF Sycamore AND COTTONWOOD TREES ALONG SONOITA CREEK, SANTA CRUZ COUNTY, ARIZONA,**  
Arizona State Univ., Tempe, Dept. of Zoology.

For primary bibliographic entry see Field 2I.  
W79-03717

**ECOLOGICAL STUDY OF SOUTHWESTERN RIPARIAN HABITATS: TECHNIQUES AND DATA AVAILABILITY,**  
Arizona State Univ., Tempe, Dept. of Zoology, and Arizona State Univ., Tempe, Center for Environmental Studies.

B. W. Anderson, R. W. Engel-Wilson, D. Wells, and R. D. Ohmart.  
In: Importance, Preservation and Management of Riparian Habitat: A Symposium, July 9, 1977, Tucson, Arizona, USDA Forest Service General Technical Report RM-43, p. 146-155. 6 fig, 1 tab, 8 ref.

Descriptors: \*Wildlife, \*Vegetation, \*Riparian land, \*Colorado River, Ecology, Ecological distribution, Riparian plants, Mammals, Rodents, Birds, Census, Density, Vegetation, Habitats, Litter, Southwest U.S., Wetlands.

Data were gathered to examine faunal community relationships to various plant community types and to gain detailed knowledge of an individual species' vegetational preference and its niche within the riparian habitat along the lower Colorado River. Examination of parameters such as habitat breadth, habitat and niche overlap and dispersal is instructive in the determination of a species' niche. (Stihler-Mass)  
W79-03721

**THE IMPORTANCE OF RIPARIAN HABITAT TO MIGRATING BIRDS,**  
Museum of Northern Arizona, Inc., Flagstaff.

For primary bibliographic entry see Field 2I.  
W79-03722

**SOME EFFECTS OF A CAMPGROUND ON BREEDING BIRDS IN ARIZONA,**  
Museum of Northern Arizona, Inc., Flagstaff.

For primary bibliographic entry see Field 4C.  
W79-03724

**SOUTHWESTERN RIPARIAN COMMUNITIES: THEIR BIOTIC IMPORTANCE AND MANAGEMENT IN ARIZONA,**  
Arizona Game and Fish Dept., Phoenix.

D. E. Brown, C. H. Lowe, and J. F. Haasler.  
In: Importance, Preservation and Management of Riparian Habitat: A Symposium, July 9, 1977, Tucson, Arizona, USDA Forest Service General Technical Report RM-43, p. 201-211. 11 fig, 56 ref.

Descriptors: \*Riparian land, \*Southwest US, \*Management, \*Ecology, Riparian plants, Vegetation, Forests, Trees, Cottonwoods, Mesquite, Wildlife, Livestock, Grazing, Ecology, Hydrology, Watershed management, Classification, Marshes, Wetlands, Streams, \*Arizona.

The distribution, ecology, vegetation and hydrology of riparian communities occurring in the southwestern United States are discussed briefly. Recommendations are made concerning the management of streamside environments and their watersheds. These include recommendations pertaining to the classification and inventory of riparian habitats; the determination of limiting factors for key riparian species; the establishment of study areas; the regulation and elimination of livestock grazing; the greater consideration of streamside vegetation in authorizing water management projects; and the more conservative use of our water-sheds. (Stihler-Mass)  
W79-03727

**TERRESTRIAL MAMMALS OF THE RIPARIAN CORRIDOR IN BIG BEND NATIONAL PARK,**  
Texas A and M Univ., College Station Dept. of Wildlife and Fisheries Sciences.

For primary bibliographic entry see Field 2I.  
W79-03728

**IMPORTANCE, PRESERVATION, AND MANAGEMENT OF RIPARIAN HABITAT: AN OVERVIEW,**  
Museum of Northern Arizona, Inc., Flagstaff, Dept. of Biology.

S. W. Carothers.  
In: Importance, Preservation and Management of Riparian Habitat: A Symposium, July 9, 1977, Tucson, Arizona, USDA Forest Service General Technical Report RM-43, p. 2-4. 9 ref.

Descriptors: \*Riparian land, \*Riparian plants, \*Arizona, Southwest U.S., Rooted aquatic plants, Birds, Wildlife, Agriculture, Flood control, Wetlands.

The imminent demise of the riparian woodland can be linked to the land utilization practices of man. Settlers cleared large expanses of natural vegetation as a source of building materials and so that the alluvial bottom soils could be put into agricultural production. As recently as the 1960's, belts of riparian woodland were being removed by water salvage and flood control agencies. Destruction of riparian vegetation has adverse effects on wildlife in these vegetation zones and in surrounding habitats. (Stihler-Mass)  
W79-03729

**AN ANALYSIS OF LAKE LEVEL INFLUENCE ON VEGETATION IN LAKE CHAMPLAIN,**  
Aquatex, Inc., South Burlington, VT.

For primary bibliographic entry see Field 2H.  
W79-03745

**SUMMARY OF AVAILABLE INFORMATION ON CHESAPEAKE BAY SUBMERGED VEGETATION,**  
Maryland Univ., Cambridge, Horn Point Environmental Lab.

For primary bibliographic entry see Field 2I.  
W79-03746

**ANNUAL METABOLISM OF A TEMPORARY POND ECOSYSTEM,**  
Cornell Univ., Ithaca, NY. Section of Ecology and

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## RESOURCES DATA—Field 7

### Data Acquisition—Group 7B

#### 7B. Data Acquisition

##### INFORMATION REQUIREMENTS FOR IMPROVING HYDROPOWER

California Univ., Los Angeles. Dept. of Engineering Systems.  
For primary bibliographic entry see Field 8C.  
W79-03542

##### MEASURING SYMBIOTIC NITROGEN FIXATION IN RANGELAND PLOTS OF TRIFOLIUM SUBTERRANEUM L. AND BROMUS MOLLIS L.

California Univ., Davis. Dept. of Agronomy and Range Science; and California Univ., Davis. Dept. of Vegetable Crops.  
D. A. Phillips, and J. P. Bennett.  
Agronomy Journal, Vol. 70, No. 4, p. 671-674, July-August, 1978. 3 fig, 1 tab, 16 ref.

Descriptors: \*Nitrogen fixation, \*Range grasses, Legumes, Clovers, \*Range management, Symbiosis, Isotop studies.

The 15N A-value technique and the acetylene reduction method were compared for their accuracy in determining seasonal symbiotic N2 fixation on a ground area basis in rangeland plots of *Trifolium subterraneum* L. and *Bromus mollis* L. To simulate range management practices, seeds were planted at 10, 141, or 1970 seeds/sq m in pure stands or 50:50 mixtures in Laughlin loam, a member of the fine-loamy, mixed, mesic family of *Ultic Haploderol*. Amounts of N2 fixed, calculated by the 15N A-value technique, varied significantly with planting density and proportion of clover at different densities. Seasonal symbiotic N2 fixation, calculated from the acetylene reduction method, did not vary significantly with either planting density or proportion of clover. It is concluded that with appropriate studies on possible differences in isotope accumulation by a grass and a legume, including morphological, physiological, and bio-chemical differences, the 15N A-value technique should be more quantitative and discriminatory than the acetylene reduction technique. The single seasonal sampling requirement of the 15N A-value technique also is more amenable to the overall goal of determining the effect of range management systems on symbiotic N2 fixation. (Skogerboe-Colorado State)

W79-03552

##### AQUATIC AND TERRESTRIAL SURVEYS IN THE VICINITY OF POWER PLANTS USING REMOTE SENSING

Calspan Corp. Buffalo, NY.  
For primary bibliographic entry see Field 5A.  
W79-03567

##### SEMI-INFINITE SOLID MODEL FOR PREDICTION OF TEMPERATURE IN DEEP RESERVOIRS AND LAKES

Arkansas Univ., Fayetteville. Dept. of Chemical Engineering.  
For primary bibliographic entry see Field 2H.  
W79-03581

##### PHYSICAL METHODS OF STUDYING ICE AND SNOW

Army. Terrestrial Science Center. Hanover, NH.  
For primary bibliographic entry see Field 2C.  
W79-03596

##### RADIOPHYSICAL METHODS FOR ANALYZING ICE AND SNOW

For primary bibliographic entry see Field 2C.  
W79-03597

##### FM RADAR SIGNALS REFLECTED FROM ICE SURFACES, AND THE POSSIBILITIES FOR MODELING THEM

For primary bibliographic entry see Field 2C.  
W79-03598

Systematics.  
For primary bibliographic entry see Field 21.  
W79-03750

**THE EFFECTS OF DITCHING A SALT MARSH ON COLONY AND NEST SITE SELECTION BY HERRING GULLS (LARUS ARGENTATUS),**  
Livingston Coll., New Brunswick, NJ. Dept. of Biology.  
J. Burger, and J. Shisler.  
The American Midland Naturalist, Vol. 100, No. 1, p. 54-63, July, 1978. 1 fig, 4 tab, 49 ref.

Descriptors: \*Salt marshes, \*Ditches, \*Gulls, \*Nesting, \*Effects, Nesting cover, Wildlife, Birds, Wetlands, Ecology, Ecological distribution, Life history studies, Habitat, New Jersey.

One-half of Sandy Island, New Jersey, which was ditched with internal ditches connected to the surrounding bay, underwent a major vegetation change as bushes replaced the naturally occurring *Spartina* over 80 percent of the area. No significant vegetational change occurred on the half of the island with only internal ditching, and the population of herring gulls moved to this area. Gulls nested in *Spartina* patens on spoil piles near bushes. As the highest in the marsh, these areas are less susceptible to storm and flood tides. The gulls nesting on spoils built higher nests, laid bigger eggs, and had a higher mean clutch size than birds that did not nest on spoil piles. Spoil piles are suggested as the preferred habitat of the older, more experienced birds. (Howard-Mass)  
W79-03752

**ENVIRONMENTALIZING AGRICULTURAL PRODUCTION CONTROL POLICIES**,  
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Economics.  
For primary bibliographic entry see Field 5G.  
W79-03767

**ENVIRONMENTAL QUALITY, THE MARKET, AND PUBLIC FINANCE**,  
Clemson Univ., S. C. Water Resources Research Inst.  
H. H. Macaulay.  
In: Modern Fiscal Issues. Richard M. Bird and John G. Head, eds., University of Toronto Press, Toronto, Canada, p. 187-224, January 1973. 4 fig, 39 ref. OWRT B-030-SC(7).

Descriptors: Compensation, \*Cost allocation, \*Economic efficiency, \*Equilibrium prices, \*Government finance, \*Payment, \*Pollution taxes/Charges, \*Competitive use, Subsidies, Regulations.

Earlier writings by Pigou, Knight, and Coase are examined to show that the problems of pollution may be analyzed more accurately if they are viewed as resulting from conflicting desires to use some presently unpriced asset. Thus, firms want to use water quality for waste disposal, while fishermen want to use it for propagation of fish. In this respect the environment is more nearly like a private good than a public good. A graphical analysis of the value placed on the environment by competing users, both public and private, is presented. Regulations, subsidies, and charges are discussed as means for attaining the optimum use of the environment. They are analyzed separately, and charges are recommended as most likely to produce an economic optimum. However, charges should be bilateral, i.e., levied on both those who wish to discharge wastes and those who wish to limit waste discharge. The government is a logical party to assume ownership where none previously clearly existed and to collect revenues for use of the environment. Funds collected should be assigned to general revenues and not necessarily used for pollution abatement unless the use provides the highest marginal return of all possible government expenditures.  
W79-03768

**EFFECTS OF OIL ON AQUATIC BIRDS.**

Fish and Wildlife Service, Laurel MD. Patuxent Wildlife Research Center.  
For primary bibliographic entry see Field 5C.  
W79-03837

**RESTORATION OF OIL-CONTAMINATED SHORELINES**,  
URS Co., San Mateo, CA.  
For primary bibliographic entry see Field 5G.  
W79-03840

##### OHIO RIVER BASIN ENERGY STUDY, ORBES PHASE I: INTERIM FINDINGS

Illinois Univ., Urbana-Champaign.  
J. J. Stukel, and B. R. Keenan.  
Interim Report No. EPA-600/7-77-120, November 1977. 170, p. 9 fig, 32 tab, 43 ref, 10 append. R804848-01.

Descriptors: \*Energy, \*Public utilities, \*Ohio River Basin, Interstate, Environmental effects, Social aspects, Social participation, Social impact, Public health, Planning, Biology, Economics, Nuclear energy, Fossil fuels, Power plants, Regional analysis, Investigations, Water supply.

An assessment of the potential environmental, social, and economic impacts of proposed powerplants and other energy conversion facilities on a large section of the Ohio River Basin is summarized. The Ohio River Basin Energy Study (ORBES) Phase I was conducted by faculty from six state universities within the study region: all of Kentucky, large parts of Illinois, Indiana, and Ohio. The two basic options, high energy-growth and low energy-growth, were analyzed, and two scenarios were created for each with varying mixes of coal-fired and nuclear-fueled energy conversion facilities. Preliminary findings of Phase I are regional and include information on natural resources, developed resources, the ecological and biological environment, public health, and economic and social factors. Major findings include: (1) air quality limitations in the region are becoming increasingly important considerations; (2) water availability limitations may become important before the year 2000; and (3) a high rate of growth may be associated with an insufficient supply of skilled labor for the construction of conversion facilities. (Davidson-IPA)  
W79-03971

**ENVIRONMENTAL EFFECTS OF OIL SHALE MINING AND PROCESSING, PART I: FISHES OF PICEANCE CREEK, COLORADO, PRIOR TO OIL SHALE PROCESSING**,  
Colorado Div. of Wildlife, Fort Collins. Fisheries Research Center.

For primary bibliographic entry see Field 5C.

W79-03974

##### ENVIRONMENTAL EFFECTS OF OIL SHALE MINING AND PROCESSING, PART II: THE AQUATIC MACROINVERTEBRATES OF THE PICEANCE BASIN, COLORADO, PRIOR TO OIL SHALE PROCESSING

Colorado State Univ., Fort Collins. Dept. of Zoology; and Colorado State Univ., Fort Collins. Dept. of Entomology.

For primary bibliographic entry see Field 5C.

W79-03975

## 7. RESOURCES DATA

### 7A. Network Design

#### EVALUATING THE SAMPLING FREQUENCIES OF WATER QUALITY MONITORING NETWORKS

Colorado State Univ., Fort Collins. Dept. of Agriculture and Chemical Engineering.

For primary bibliographic entry see Field 5C.

W79-03976

## Field 7—RESOURCES DATA

### Group 7B—Data Acquisition

**EFFECT OF ICE STRUCTURE ON ITS RADIATION CHARACTERISTICS IN THE SHF RANGE.**  
For primary bibliographic entry see Field 2C.  
W79-03599

**PROPAGATION OF RADIO WAVES IN GLACIERS.**  
For primary bibliographic entry see Field 2C.  
W79-03600

**RADIO SOUNDING OF SEA ICE.**  
For primary bibliographic entry see Field 2C.  
W79-03601

**EMISSIVITY OF ICE, TERRESTRIAL, AND SEA SURFACES MODELED BY STRATIFIED HETEROGENEOUS STRUCTURES.**  
For primary bibliographic entry see Field 2C.  
W79-03602

**MEASUREMENT OF REFLECTED SIGNALS DURING RADAR SOUNDING IN A LARGE RANGE OF ANGLES.**  
For primary bibliographic entry see Field 2C.  
W79-03603

**DEPOLARIZATION OF REFLECTED RADIO SIGNALS.**  
Z. Klau Dzh.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 42-47, August 1976. 1 fig, 6 ref.

Descriptors: \*Radio waves, \*Ice, \*Ice cover, Remote sensing, Radar, Measurement, Snow, Reflectance, Microwaves, Anisotropy, On-site investigations, Depolarization, Reflected signals, Ice shelf.

Elliptical and linear depolarization of reflected radio signals propagating in a glacier were examined. Elliptical depolarization is usually the result of propagation in an anisotropic medium. Linear depolarization occurs with reflection from a rough surface. Depolarization observed at Skelton glacier in 1966 can be ascribed to both mechanisms. Signals coming from great depths (10 microseconds) depolarize as a result of internal reflections at the South Pole, while signals coming from lesser depths (5 microseconds) are not depolarized. (See also W79-03596) (Sims-ISWS) W79-03604

**REMOTE MEASUREMENT OF THE THICKNESS OF SEA ICE BY RADAR METHODS.**  
M. I. Finkel'shteyn, V. A. Kutev, V. G. Glushnev, and E. I. Lazarev.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 48-51, August 1976. 1 fig, 1 tab, 10 ref.

Descriptors: \*Remote sensing, \*Sea ice, \*Radar, Measurement, Ice, Sounding, Radio waves, Microwaves, Salinity, Electronics, Electromagnetic waves, Ice thickness.

This article examined the simple radio pulse method, the shock antenna excitation method, and the video pulse method with a correction. The cited experimental data confirmed that use of the last method permits measurement of the thickness of highly saline sea ice beginning with 50-60 cm. At an ambient air temperature below -22°C, the mean velocity of radio waves in ice is 130 m/microsecond. (See also W79-03596) (Sims-ISWS) W79-03605

**INSTRUMENTS FOR ANALYZING SPECTRAL REFLECTION OF LIQUID WATER IN THE WAVELENGTH RANGE FROM 1 TO 50 MICRONS,**  
Vsesoyuznyi Elektrotekhnicheskii Inst., Moscow

(USSR). Dept. of the Fundamentals of Electronic Engineering.

M. A. Kropotkin.  
In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 73-78, August 1976. 2 fig, 9 ref.

Descriptors: \*Optical properties, \*Water, \*Laboratory tests, \*Reflectance, Instrumentation, Equipment, Physical properties, Water properties, Spectrometers, Radiation, Infrared radiation, Reflection factor.

An attachment to a standard single-beam infrared spectrometer used to measure spectral reflection factors in the wavelength range from 1 to 20 microns, and a special device to measure reflections in the wavelength zone from 20 to 50 microns were described. The latter consists of a single-beam infrared spectrometer with exchangeable diffraction grids and an optical system which to focus radiation either onto a sample or onto a receiver, located beneath a reflecting hemisphere. A convergent beam with an apex angle of 5 deg fell on the water surface under analysis for all measurements. It was demonstrated that when the reflecting hemisphere in the described apparatus is replaced by a reflecting hemispherical, it can be used to analyze the infrared reflection spectrum of snow and ice. (See also W79-03596) (Sims-ISWS) W79-03610

**THE PROBLEM OF STUDYING CHARGE GENERATION ON THE PHASE INTERFACE OF 0.001 MOLAR SODIUM CHLORIDE SOLUTION UNDERGOING DIRECTED FREEZING,**  
For primary bibliographic entry see Field 2C.  
W79-03611

**LOW FREQUENCY POLARIZATION OF ICE IN FROZEN COARSE-DISPERSION FORMATIONS,**  
For primary bibliographic entry see Field 2C.  
W79-03614

**COASTAL ICE DYNAMICS ACCORDING TO SLAR OBSERVATIONS,**

S. M. Losev, and Yu. A. Gorbunov.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 102-111, August 1976. 3 fig, 4 tab, 7 ref.

Descriptors: \*Remote sensing, \*Sea ice, \*Radar, \*Coasts, Aircraft, Drifting(Aquatic), Islands, Ice cover, Movement, Photography, Aerial photography, Side-looking airborne radar, Ice dynamics, Ice compression, Ice compactness, Drift velocity.

Specific features of the dynamics of ice on polar seas were analyzed on the basis of observations by a side-looking airborne radar set with an observation interval of 2 days. It was established that the effect of islands on movement of compacted ice on the drift side extends for a distance equal to 5 cross sections of the island with respect to the normal to the drift. The zone of influence is half as great on the opposite side. Data indicating a significant difference in the influence of the shore on change in the normal and tangent components of the drift velocity vector as the distance from land increases were presented. Relative deformation of the area of an ice cover surface element was used to study ice compression and rarefaction. On the whole, the research results indicated the great possibilities for using side-looking radar to study the kinematics and dynamics of ice cover in greater depth. (See also W79-03596) (Sims-ISWS) W79-03615

**SEA SURFACE TEMPERATURE OBSERVATIONS BY A RADIATION THERMOMETER ABOARD AN ICE RECONNAISSANCE AIRCRAFT,**

A. I. Paramonov, Yu. A. Gorbunov, and S. M. Losev.

In: Physical Methods of Studying Ice and Snow,

Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 112-118, August 1976. 2 fig, 2 tab, 2 ref.

Descriptors: \*Remote sensing, \*Temperature, \*Oceans, \*Sea ice, \*Arctic, Aircraft, Equipment, Electronic equipment, Surveys, Water temperature, Infrared radiation, Ice, Ice cover, Oceanography, Sea surface temperature, Radiation thermometers.

The results of an inspection of the precision by which a PRT-5 radiation thermometer can measure the temperature of the sea surface, performed in August-September 1973 in the eastern Arctic, were presented. The observation materials confirmed the possibility of using this radiometer during airborne ice reconnaissance to measure water temperature on the sea surface, not only in the presence of ice but also in areas of open water between ice blocks of different degrees of compactness. Also, it was demonstrated that during the time of freezing, the temperature of ice of different ages differs significantly. (See also W79-03596) (Sims-ISWS) W79-03616

### USE OF ACOUSTIC METHODS TO ANALYZE SNOW AND ICE,

V. P. Gavrilov, and A. V. Gusev.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 119-125, August 1976. 2 fig, 6 ref.

Descriptors: \*Remote sensing, \*Acoustics, \*Snow, \*Ice, Physical properties, Mechanical properties, Temperature, Density, Salinity, Pressure, Sound waves, Ice-water interfaces, Elasticity(Mechanical), Viscosity, Laboratory tests, On-site investigations.

Grounds were given for the extensive possibilities of acoustic methods to study physical characteristics of freshwater, sea, and glacier ice and snow cover. Pulsed ultrasonic and resonant methods permitted a broad complex of measurements to determine the elastic characteristics of various types of ice and snow (for example Young's modulus, the shear modulus, the Poisson ratio, the viscosity coefficient, and attenuation and scattering of ultrasonic oscillations in ice depending on temperature, density, salinity, and static pressure). These measurements can be used to predict the mechanical properties of ice cover if data on its temperature and salinity are available. The applied significance of such research was demonstrated. (See also W79-03596) (Sims-ISWS) W79-03617

### ATTENUATION AND SCATTERING OF SOUND WAVES BY SEA ICE,

V. V. Bogorodskiy, G. Ye. Smirnov, and S. A. Smirnov.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 126-132, August 1976. 2 fig, 4 ref.

Descriptors: \*Attenuation, \*Absorption, \*Sound waves, \*Sea ice, Sonar, Remote sensing, Laboratory tests, On-site investigations, Ice, Oceans, Temperature, Crystals, Ultrasonics, Measurement, Theoretical analysis, Ice thickness.

Theoretical and experimental research on absorption and scattering of ultrasonic waves by sea ice structure was presented in this work. Explanations of the observed effects were given, and it was demonstrated that sea ice has different acoustic contrasts, which can be used to visualize the lower ice surface. (See also W79-03596) (Sims-ISWS) W79-03618

### ONE METHOD FOR MEASURING SOUND ATTENUATION IN NATURAL ICE,

N. A. Grubnik, and O. V. Kudryavtsev.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and

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**SEISMIC ANALYSIS**  
V. N. Smirnov  
In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 1

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## RESOURCES DATA—Field 7

### Data Acquisition—Group 7B

Engineering Laboratory, Hanover, New Hampshire, p 133-134, August 1976. 2 ref.

Descriptors: \*Attenuation, \*Sound waves, \*Ice cover, Ice, Properties, On-site investigations, Measurements, Sea ice, Glaciers, Lake ice, Correlation analysis.

A method was described for direct measurement of attenuation of sound waves in natural ice based on using a complex wideband acoustic signal followed by its optimum processing. Attenuation coefficients were determined on the basis of the degree to which correlation maximums (observed upon matching of the instantaneous frequencies of the reference and directly received signals) decline, depending on range. (See also W79-03596)(Sims-ISWS)

W79-03619

#### SEISMIC AND TILT METER METHODS FOR ANALYZING ICE COVER,

V. N. Smirnov, and Ye. M. Lin'kov.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 135-139, August 1976. 1 fig, 1 tab, 4 ref.

Descriptors: \*Seismic studies, \*Ice cover, \*Seismic waves, Ice, Sea ice, Lake ice, Loads(Forces), Stress, Elasticity(Mechanical), Deformation, Gravity waves, Mechanical properties, Physical properties, Ice breakup, Flexural-gravitational waves.

Two examples of ice cover analysis employing seismic methods were examined. The moduli of elasticity of ice cover determined by means of sag in response to a load and a dynamic method were compared. It was revealed from observations at the Severny Polyus-20 station that triggering stresses causing ice breakup arise when trains of flexural-gravitational waves appear suddenly in ice. (See also W79-03596)(Sims-ISWS)

W79-03620

#### ANALYSIS OF GLACIER DYNAMICS USING A LASER DEFORMOGRAPH,

For primary bibliographic entry see Field 2C.

W79-03621

#### A METHOD FOR MEASURING HIGH MOISTURE RESERVES IN SNOW COVER USING COSMIC RADIATION,

S. I. Avdyushin, Yu. F. Barabanshchikov, R. M. Kogan, Yu. M. Kulagin, and I. M. Nazarov.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 169-173, August 1976. 1 fig, 7 ref.

Descriptors: \*Snow cover, \*Moisture content, \*Remote sensing, Radiation, Measurement, Instrumentation, Equipment, Mountains, Snowpacks, Snow surveys, Water resources, Snow, Cosmic radiation.

A system for measuring moisture reserves in monsoon snow was examined. The system is based on taking account of attenuation of galactic cosmic radiation by snow. The applicability of this system to measurement of moisture reserves at thicknesses from several hundred to several thousand millimeters was demonstrated. The apparatus was described, and the results of a long-term experiment at the high-altitude Kharlam-Kul' Station of the Tadzhik SSR Administration of Hydrometeorological Service to determine water reserves in snow by means of recording galactic cosmic particles were presented. It was demonstrated that when the moisture reserves are from 10 to 900 mm, the precision with which they can be measured is 34 mm. It was noted that the greater part of error stems from daily variations in galactic cosmic radiation. A way to reduce this error was shown. (See also W79-03596)(Sims-ISWS)

W79-03622

#### A RADIO HYDROACOUSTIC METHOD FOR ANALYZING MODERATE-RANGE CHARACTERISTICS OF SEA ICE DYNAMICS,

V. V. Bogorodskiy, V. P. Gavrilov, and A. P. Polyakov.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 220-229, August 1976. 3 fig, 1 tab, 11 ref.

Descriptors: \*Sea ice, \*Movement, \*Remote sensing, Radio, Acoustics, Model studies, Mathematical models, On-site investigations, Aerial photography, Ice, Cold regions, Arctic, Measurement, Equipment, Instrumentation, Ice movement, Ice breakup.

The basic physical premises of the radio hydroacoustic method for analyzing sea ice dynamics were developed. An experimental assessment was given of the precision of the method under the conditions of drifting ice on the Arctic Ocean, which assumes a value on the order of 0.01-0.03% of the measured range (about 20-30 km), not taking account of the effect of medium variability during the time of measurement. Models of drifting automatic radio hydroacoustic stations, which were used to make the first measurement of moderate-range characteristics of sea ice dynamics, were manufactured and tested. (See also W79-03596)(Sims-ISWS)

W79-03633

#### THE LANDSAT LAKE EUTROPHICATION STUDY,

Wisconsin Univ.-Madison. Dept. of Civil and Environmental Engineering.

K. W. Holmquist.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 678, Price codes: A06 in paper copy, A01 in microfiche. M.S. Thesis, 1977. 94 p., 11 fig, 6 tab, 12 ref, 6 append. OWRT A-062-WIS(2), 14-34-0001-5050, 14-34-0001-620

Descriptors: \*Lakes, \*Eutrophication, \*Computer programs, \*Remote sensing, Time series analysis, \*Classification, Computer programs, Trophic levels, \*ERTS, \*LANDSAT imagery, \*Wisconsin.

A cooperative program between the Wisconsin Department of Natural Resources and the University of Wisconsin has resulted in an initial assessment of the trophic status of inland lakes in the State of Wisconsin from LANDSAT data. The feasibility of using both the photographic representation of the LANDSAT imagery as well as the digital representation of the LANDSAT imagery to classify lakes was investigated. It was determined that LANDSAT imagery can be used to predict lake water parameters or trophic classification. Time series data analyses indicated the necessity of a periodic rather than a one-time data extraction process. The best lake classification can be derived from the digital representation of LANDSAT. Accounting for the differences in atmospheric conditions from day to day is an important consideration in the analysis of LANDSAT imagery. A collection of computer programs has been developed to derive lake trophic status from LANDSAT imagery which correlates well with ground calibration. This analysis technique is a cost-effective method of classifying inland lakes in Wisconsin.

W79-03682

#### APPARATUS AND METHOD FOR SAMPLING WATER FOR FISH LARVAE AND OTHER TROPHIC LEVELS,

Lawler, Matusky and Skelly Engineers, Tappan, NY. (Assignee)

P. M. McCroddy.

U.S. Patent No 4,117,726, 7 p, 6 fig, 2 ref, Official Gazette of the United States Patent Office, Vol 975, No 1, p 63, October 3, 1978.

Descriptors: \*Patents, \*Sampling, \*On-site investigations, \*Environmental effects, Water quality, Cooling water, Aquatic life, Fish, Larvae, Electric powerplants.

Samples of fish life in the larvae and egg stage and shortly thereafter, plankton and similar marine life are obtained by a two stage fine mesh partitions apparatus. By taking samples before and after water has passed through cooling facilities of electric generating plants along a river, some of the effects of the powerplant on the environment can be determined. The outstanding feature of this invention is that it collects the samples without passing the marine life through pumps in which much of it is killed or injured. Samples are collected in partially submerged equipment into which the water flows by gravity, and the water is discharged by pumps after the samples have been removed. (Sinha-OEIS)

W79-03781

#### WATER COLLECTION INDICATOR DEVICE,

For primary bibliographic entry see Field 3F.

W79-03785

#### MAP UNIT COMPOSITION ASSESSMENT USING DRAINAGE CLASSES DEFINED BY LANDSAT DATA,

Soil Conservation Service, Lafayette, IN.

F. R. Kirschner, S. A. Kaminsky, R. A.

Weismiller, H. R. Sinclair, and E. J. Hinzel.

Soil Science Society of America Journal, Vol. 42, No. 5, p 768-771, September-October 1978. 3 fig, 2 tab, 15 ref. NASA NGL-15-005-186.

Descriptors: \*Soil classification, \*Drainage, \*Remote sensing, \*Satellites(Artificial), Soils, Soil types, Soil moisture, Vegetation, Mapping, Loam, Silts, Maps, Soil science, LANDSAT.

Soil survey map units are designed such that the dominant soil represents the major proportion of the unit. At times, soil mapping delineations do not represent adequately conditions as stated in the map unit descriptions. Digital analysis of LANDSAT multispectral scanner (MSS) data provides a means of accurately delineating and quantifying soil map unit composition. Digital analysis of LANDSAT MSS data collected on 9 June 1973 was used to prepare a spectral map for a 430-ha area in Clinton County, Indiana. Sixteen spectral classes were defined, representing 12 soil and 4 vegetation classes. The 12 spectral soil classes correlated with soil drainage characteristics and were grouped into four drainage classes. The four spectral vegetation classes were grouped for convenience into one vegetation class. The soil delineation produced using these groupings were compared to a conventionally prepared soil map. Three map units were investigated in detail: (1) Mahalasville silty clay loam, poorly drained; (2) Reesville silt loam, 0 to 2% slopes, somewhat poorly drained; and (3) Xenia silt loam, 2 to 6% slopes, eroded, moderately well drained. Results indicated that soil drainage characteristics can be identified. Correlation of drainage characteristics with soil series allows for the composition of soil map units to be accurately ascertained. (Sims-ISWS)

W79-03802

#### GRAVIMETRIC VS. VOLUMETRIC DETERMINATION OF WATER STORAGE IN VERTICALLY UNSTABLE TILLAGE LAYERS,

Agricultural Research Organization, Bet Dagan (Israel). Inst. of Soils and Water.

R. Steinhardt.

Soil Science Society of America Journal, Vol. 42, No. 5, p 836-837, September-October 1978. 1 tab, 14 ref.

Descriptors: \*Water storage, \*Soil water, \*Moisture content, Analytical techniques, Irrigation, Wetting, Drying, Water utilization, Soil compaction, Drainage, Frost heaving, Methodology, Gravimetric analysis, Volumetric analysis, Soil science.

Methods of determining water storage (W) in a tillage layer of changing height were analyzed to compare the effects of agrotechnical management on W. Changes in W may be evaluated from a single estimate of the solid mass per unit area at a state of reference and periodic observations of the

## Field 7—RESOURCES DATA

### Group 7B—Data Acquisition

gravimetric water content of the tillage layer, which is equivalent to the usual procedure in stable soils. (Sims-ISWS)  
W79-03806

**MEASUREMENT OF FURROW INFILTRATION RATES MADE EASY.**  
Science and Education Administration, Prosser, WA. Federal Research.  
D. E. Miller, and W. W. Rasmussen.  
Soil Science Society of America Journal, Vol. 42, No. 5, p 838-839, September-October 1978. 3 fig. 1 tab. 9 ref.

Descriptors: \*Infiltration, \*Irrigation, \*Infiltrometers. On-site investigations. Irrigation systems. Furrow irrigation. Measurement. Flow rates. Data processing. Instrumentation. Flow control. Agriculture.

An irrigation system was developed for infiltration studies. The system utilized overflow controls to maintain nearly constant inflow into irrigation furrows. Furrow outflow was measured with HS flumes equipped with water level recorders. Data were converted easily and rapidly to infiltration rates and cumulative infiltration by a computer. (Sims-ISWS)  
W79-03807

**COMPARISON OF CALCULATED AND EXPERIMENTALLY DETERMINED VALUES OF SOIL-WATER DIFFUSIVITY.**  
Haryana Agricultural Univ., Hissar (India). Dept. of Soils.  
For primary bibliographic entry see Field 2G.  
W79-03812

**THE CULTURE COLLECTION POINT OF VIEW.**  
Culture Centre of Algae and Protozoa, Cambridge (England).  
For primary bibliographic entry see Field 5A.  
W79-03845

**A MODIFIED TURBIDOSTATIC SYSTEM FOR ALGAL POPULATION STUDIES.**  
Euratom European Community, Varese (Italy).  
For primary bibliographic entry see Field 5A.  
W79-03847

**X-RAY ANALYSIS OF AIRBORNE ASBESTOS, DESIGN AND CONSTRUCTION OF A PROTOTYPE ASBESTOS ANALYZER.**  
Naval Research Lab., Washington, DC. Radiation Technology Div.  
For primary bibliographic entry see Field 5A.  
W79-03967

**PROCEEDINGS OF THE SECOND WORKSHOP ON SAMPLING GEOTHERMAL EFFLUENTS.**  
For primary bibliographic entry see Field 5A.  
W79-03987

### 7C. Evaluation, Processing and Publication

**LOWER SANTEE RIVER ENVIRONMENTAL QUALITY STUDY; AN ASSESSMENT OF SELECTED BIOLOGICAL AND PHYSICAL PARAMETERS.**  
South Carolina Water Resources Commission, Columbia.  
For primary bibliographic entry see Field 5B.  
W79-03513

**CONTINUOUS SIMULATION OF NONPOINT POLLUTION.**  
Ramlit Associates, Berkeley, CA.  
For primary bibliographic entry see Field 5B.  
W79-03515

### SIMULATION PROCEDURES FOR BOX-JENKINS MODELS.

University of Western Ontario, London.  
For primary bibliographic entry see Field 2E.  
W79-03523

**SIMULATION OF ADVANCED WASTEWATER TREATMENT SYSTEMS.**  
Waterloo Univ. (Ontario). Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5D.  
W79-03524

**RECENT DEVELOPMENTS IN THE MCCLELLAN-KERR ARKANSAS RIVER NAVIGATION SYSTEM AREA.**  
Army Engineer Div., Southwestern Dallas, TX.  
For primary bibliographic entry see Field 4A.  
W79-03526

**METEOROLOGICAL ANALYSIS OF AN OAHU FLOOD.**  
Hawaii Univ., Honolulu. Dept. of Meteorology.  
For primary bibliographic entry see Field 2E.  
W79-03580

**MAGNETIC SURVEY OF ICE WEDGES.**  
For primary bibliographic entry see Field 2C.  
W79-03613

**ON THE THEORY AND MODELING OF DYNAMIC PROGRAMMING WITH APPLICATIONS IN RESERVOIR OPERATION.**  
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.  
For primary bibliographic entry see Field 4A.  
W79-03671

**THE LANDSAT LAKE EUTROPHICATION STUDY.**  
Wisconsin Univ.-Madison. Dept. of Civil and Environmental Engineering.  
For primary bibliographic entry see Field 7B.  
W79-03682

**METHODOLOGIES OF EXAMINING POLLUTION FROM URBAN RUNOFF.**  
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Civil and Environmental Engineering.  
For primary bibliographic entry see Field 5B.  
W79-03689

**ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN LYNN AND GRAZA COUNTIES, TEXAS. PROJECTIONS OF SATURATED THICKNESS, VOLUME OF WATER IN STORAGE, PUMPAGE RATES, PUMPING LIFTS, AND WELL YIELDS.**  
Texas Dept. of Water Resources, Austin.  
For primary bibliographic entry see Field 4B.  
W79-03818

### CONTRIBUTIONS TO THE HYDROGEOLOGY OF ALBERTA.

Alberta Research Council, Edmonton. Groundwater Div.  
For primary bibliographic entry see Field 2F.  
W79-03819

### THE HYDROGEOLOGICAL RECONNAISSANCE MAPS OF ALBERTA.

Alberta Research Council, Edmonton. Groundwater Div.  
J. Toth.  
In: Contributions to the Hydrogeology of Alberta, Bulletin 35, Alberta Research Council, Edmonton, p 1-11, 1977. 5 fig, 33 ref.

Descriptors: \*Hydrogeology, \*Areal hydrogeology, \*Mapping, \*Canada, Geology, Maps, Groundwater, Wells, Water wells, Data collections, Surveys, Aquifers, Water resources, Water

quality, \*Water yield, \*Hydrology, Alberta(Canada).

In 1968, a program of hydrogeological reconnaissance mapping in Alberta was started by the Alberta Research Council, with completion envisaged in approximately 11 years. The purpose of the program is to publish hydrogeological maps, graphic portrayals of the groundwater conditions and their controlling factors—for each of 47 different areas in the province. These maps will provide an overview of the hydrogeological conditions in the province, and will assist in the solution of groundwater-related problems such as water resources development, land use planning, civil engineering and environmental queries, basic and applied research, and the planning of future research projects. The maps are published at the scales of 1:125,000, 1:250,000 or 1:500,000, depending upon the amount of available data. The main items on a typical map sheet are a central main map, 4 hydrogeological cross sections, 4 to 6 side maps, a conversion table and a legend. The maps, though self-contained, are accompanied by short reports which give information on features not readily illustrated pictorially. The sources of basic data include water well drillers' reports, oil company information, geological reports, chemical analysis of water samples, field surveys, test drilling, and pump testing. The maps are produced at a rate of one map sheet per geologist per year, or a total of 2 to 4 map sheets annually. Out of the approximately 47 map areas of the province, 32 have been mapped to date, and maps for 15 areas have been published. The average cost of the completed maps to the Alberta Research Council is approximately \$15.50/sq mi (\$6.00/sq km) of area mapped. (See also W79-03819)(Sims-ISWS)  
W79-03820

**APPARENT TRANSMISSIVITY AND ITS DETERMINATION BY NOMOGRAPH.**  
Alberta Research Council, Edmonton. Groundwater Div.  
For primary bibliographic entry see Field 2F.  
W79-03821

**DLSLOT: A COMPUTER PROGRAM FOR TRANSLATING DOMINION LAND SURVEY COORDINATES TO UNIVERSAL TRANSVERSE MERCATOR COMPATIBLE COORDINATES.**  
Alberta Research Council, Edmonton. Groundwater Div.  
A. T. Lytviak.

In: Contributions to the Hydrogeology of Alberta, Bulletin 35, Alberta Research Council, Edmonton, p 65-92, 1977. 7 fig, 1 tab, 1 ref, 1 append.

Descriptors: \*Mapping, \*Computer programs, \*Maps, Geologic mapping, Data processing, Data collections, Analytical techniques, Groundwater, Hydrography, Hydrologic data, Well data, Projecting, Hydrology, Hydrogeologic mapping, Coordinate mapping, Coordinate systems, Coordinate translation, Map coordinates, Geography.

The computerization of many phases in the production of the reconnaissance hydrogeological map series has encountered difficulties inherent to mapping in a complex coordinate system. The National Topographic System, using Transverse Mercator projections, has polar coordinates. The Dominion Land Survey system is a synthesis of orthogonal and polar coordinate systems. The computer output device operates in an orthogonal system. If Dominion Land Survey coordinates are used as input and National Topographic System compatible maps are desired as output, mapping by computer must invoke a suitable translation program. The construction of such a program was undertaken by simplifying the coordinate system to a maximum extent consistent with keeping the resultant errors within set limits. The scale of 1:250,000 was used as a criterion for acceptability, as this scale is most commonly used in the reconnaissance map series. Simplicity of utilization was achieved by minimizing the parameters necessary to define the area to be plotted. Three parameters were found necessary and additional ones useful. These parameters were

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## Soil Mechanics—Group 8D

ers were: horizontal field in ranges, the vertical field in townships the scale as a ratio, and two adjustment factors. (See also W79-03819)(Sims-ISSWS) W79-03826

with a partially closed-cycle loop appears to be the most attractive configuration for meteorological conditions of Sioux City, Iowa. Combination wet tower/once-through cooling systems are more economical than once-through cooling associated with low river heat assimilation capacity. This report is Volume II of the Final Report to the Office of Water Research and Technology; Volume I is IHR Report No 191 entitled: 'Analysis of Different Types of Dry-Wet Cooling Towers'. IHR Limited Distribution Report No 58 contains the computer program listings and input data which were used to perform the calculations. (See also W79-03661) W79-03662

## ANALYSIS OF DIFFERENT TYPES OF DRY-WET COOLING TOWERS,

Iowa Univ., Iowa City. Inst. of Hydraulic Research.

M. S. Cheng, T. E. Croley, II, and V. C. Patel. Available from the National Technical Information Service, Springfield, VA. 22161 as PB-261 315. Price codes: A09 in paper copy, A01 in microfiche. Final Report Volume I IHR Report No. 191, July 1976. 169p, 45 fig, 9 tab, 72 ref. OWRT C-6011(5201)(2), 14-31-0001-5201.

Descriptors: \*Consumptive use, \*Cooling towers, \*Powerplants, \*Thermal pollution, \*Thermal powerplants, \*Water cooling, \*Water consumption, Dry cooling, Dry-wet combination, Cooling system design, Waste heat, Wet cooling.

A comprehensive computer code was developed for the assessment of the economics of various types of combination dry-wet cooling towers for steam-electric power plants. The model considered the basic thermodynamics of wet (evaporative) and dry (conductive) heat transfer, steam turbines, condensers, and the influence of different power loading patterns and changing meteorological conditions, as well as the various economic parameters. In the latter category are the capital costs associated with the equipment as well as the lost capacity at extreme meteorological conditions, and the operating costs resulting from fuel consumption, water usage, maintenance, internal power requirements, and under-production of energy. Studies were made of the thermodynamic and economic performance of several parallel and series air path dry-wet cooling tower configurations. In addition to demonstrating the general usefulness of the models, several promising configurations were identified which seem attractive in their economic, water conservation, and fog abatement aspects. In particular, it parallel air path towers are more flexible and effective than comparable series air path arrangements. The most favorable configuration is the one in which separate dry and wet units of conventional design are utilized simultaneously. Combination dry-wet cooling towers are economical in comparison with conventional wet towers when the cost of water is sufficiently high. (See also W79-03662) (Giaquinta-Iowa) W79-03661

## 8B. Hydraulics

## 8. ENGINEERING WORKS

## THE CIVIL ENGINEER'S RESPONSIBILITY IN IMPACT ANALYSIS.

American Society of Civil Engineers, New York. Committee on Impact Analysis of the Water Resources Planning. For primary bibliographic entry see Field 6G. W79-03541

## 8C. Hydraulic Machinery

## POWER DEVELOPMENT AND WATER ALLOCATION IN OHIO RIVER BASIN,

Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.

For primary bibliographic entry see Field 4A. W79-03537

## INFORMATION REQUIREMENTS FOR IMPROVING HYDROPOWER,

California Univ., Los Angeles. Dept. of Engineering Systems.

W. W.-G. Yeh, L. Becker, and R. L. Sohn. Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 104, No WRI, p 139-156, November 1978. 4 fig, 11 tab, 37 ref. W79-03661

Descriptors: \*Hydroelectric power, \*Remote sensing, \*Streamflow forecasting, \*Information systems, Flood control, Decision making, Reservoirs, \*Watersheds(Basins), Multiple-purpose reservoirs, Optimization, California, Sensitivity analysis, Energy loss, Runoff, Mathematical models, Systems analysis.

A method of analysis is described with the objective of determining how (and whether) aerospace-derived information system technology can effectively increase hydropower production. The increase in annual hydropower benefits is derived from more accurate reservoir inflow forecasting based upon the use of new or improved sensors and satellite data relay systems. Sensitivity analyses are presented for watershed parameters imbedded in conceptual watershed models. Results are related to hydropower production and sensor requirements via a reservoir optimization model to establish information system requirements. A numerical example is presented using a typical multiple-purpose reservoir system located in northern California (Bell-Cornell) W79-03542

## WET/DRY COOLING SYSTEMS FOR FOSSIL-FUELED POWER PLANTS: WATER CONSERVATION AND PLUME ABATEMENT,

United Engineers and Constructors, Inc., Philadelphia, PA.

For primary bibliographic entry see Field 5G. W79-03547

## HEAT STORAGE WELLS: KEY TO LARGE-SCALE COGENERATION.

General Electric Co., Santa Barbara, CA. Center for Advanced Studies.

For primary bibliographic entry see Field 4B. W79-03586

## OPTIMUM COMBINATIONS OF COOLING ALTERNATIVES FOR STEAM-ELECTRIC POWER PLANTS,

Iowa Univ., Iowa City. Inst. of Hydraulic Research.

T. E. Croley, II, A. R. Giaquinta, R. M. H. Lee, and T.-D. Hsu. Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 576. Price codes: A09 in paper copy, A01 in microfiche. IHR Report No 212, July 1978. 166 p, 75 fig, 15 tab, 72 ref. OWRT C-6011(5201)(3). 14-31-0001-5201.

Descriptors: \*Thermal powerplants, \*Cooling systems, Cooling ponds, \*Cooling towers, Once-through, \*Economic analysis, Waste heat, Water consumption, Thermal pollution, \*Alternative planning.

An overview of cooling alternatives and detailed system thermodynamics are presented. Computer models are developed and used to study the thermal characteristics, economics, and water consumption of wet tower/cooling pond and wet tower/once-through combination cooling systems. The effects of both meteorological conditions and economic parameters are examined to identify optimum cooling system configurations for several case studies. The case studies illustrate the cooling system arrangements which are attractive from both their economic or water conservation aspects. The combination cooling systems also are compared with dry/wet cooling systems. The parallel water path configuration of the wet tower/cooling pond combination cooling system is economically superior to the series water path configuration for meteorological conditions of Los Angeles, California. For the wet tower/once-through combination cooling system, a series water-path arrangement

## METHOD AND APPARATUS FOR CONTROLLING A WATER TURBINE,

Leyprie - Creusot Loire, Grenoble (France). (Assignee); and Compagnie Nationale du Rhone, Lyons (France). (Assignee).

L. Megnint. U.S. Patent No. 4,120,602, 5 p, 3 fig, 10 ref. Official Gazette of the United States Patent Office, Vol. 97, No. 3, p. 1043, October 17, 1978.

Descriptors: \*Patents, \*Water control, \*Hydraulic turbines, Bulb turbines, Sluice gates, Flow control, Guide vanes.

With a view to simplifying the structure of mobile guide vane assemblies and in particular those of bulb type turbines, the invention provides a method of controlling the operation of a bulb type water turbine. The mobile guide vane assembly serve only to deflect the water during operation, the starting and stopping of the turbine being controlled and water-tight sealing when the turbine is stopped provided by a gate sluice. Under these conditions, the guide vane assembly need not be water-tight and it comprises vanes having limited angular play which is sufficient to produce the required deflection of water during operation of the turbine. The clearance between the guide vanes and the housing plates can be greater, hence allowing a more simplified shape of the parts and machining which is not so precise. It is also possible to impart a better hydraulic shape to the vanes. Lastly, the number and the length of the vanes can be reduced, for the guide vane assembly no longer has to close the duct completely. (Sinha-OEIS) W79-03795

## ECONOMIC ANALYSIS, ROOT CONTROL, AND BACKWATER FLOW CONTROL AS RELATED TO INFILTRATION/INFLOW CONTROL,

American Public Works Association, Chicago, IL. For primary bibliographic entry see Field 5G. W79-03841

## 8D. Soil Mechanics

## INVESTIGATION OF THE FEASIBILITY OF DEWATERING BURIED VALLEY SANDS TO AID SEWER-TUNNEL EXCAVATIONS, EDMONTON, ALBERTA,

Alberta Research Council, Edmonton. Groundwater Div.

G. M. Gabert.

In: Contributions to the Hydrogeology of Alberta. Bulletin 35, Alberta Research Council, Edmonton, p 41-53, 1977. 14 fig, 2 tab, 3 ref.

Descriptors: \*Dewatering, \*Tunnels, \*Sands, Sand aquifers, Wells, Water wells, Pumping, Observation wells, Drawdown, Tunnel failure, Sewers, Structures, Geology, Aquifers, Engineering, Civil engineering.

\*Edmonton(Alberta), \*Alberta(Canada), Drawdown curves, Sand flows.

Excavation of a large-diameter sewer tunnel in the City of Edmonton was brought to a halt twice in 1973 because of the flow of saturated sand into the tunnel from the excavation front. A production well and observation wells were installed, and an aquifer test was conducted to provide basic data to calculate the feasibility of dewatering buried valley

## Field B—ENGINEERING WORKS

### Group 8D—Soil Mechanics

sands overlying the tunnel. Conclusions showed: (1) that dewatering is feasible using 20 wells spaced 10 ft apart in an arrangement of two lines 30 ft apart parallel and adjacent to each side of the position of the tunnel; (2) that well completions can be inexpensive and that each well would have to be pumped at 25 igpm or higher; and (3) that at least 1 week or more of continuous pumping would be required. (See also W79-03819)(Sims-ISWS) W79-03824

### 8G. Materials

#### PHYSICAL METHODS OF STUDYING ICE AND SNOW.

Army Terrestrial Science Center, Hanover, NH. For primary bibliographic entry see Field 2C. W79-03596

#### MECHANICAL PROPERTIES OF SNOW AS A CONSTRUCTION MATERIAL.

A. F. Vuori.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 155-162, August 1976. 3 fig, 1 tab, 14 ref.

Descriptors: \*Snow, \*Mechanical properties, \*Construction materials, \*Cold weather construction, Foundations, Roads, Road construction, Runways, Construction, Cold regions, Loads(Forces), Deformation, Stress, Density, Strength, Strength of materials, Rheology.

Various snow processing methods can be used to transform snow into a useful construction material in polar regions, where use of conventional construction materials is uneconomical or impossible. This transformation is associated with significant change in mechanical properties of snow. This work was devoted to the results of research on this change. The problems of using compacted snow to build roads, runways, and foundations for various structures were examined. (See also W79-03596)(Sims-ISWS) W79-03624

#### METHODS FOR MEASURING THE STRENGTH CHARACTERISTICS OF NATURAL AND PROCESSED SNOW.

G. Abel.

In: Physical Methods of Studying Ice and Snow, Draft Translation 539, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, p 174-184, August 1976. 3 fig, 3 tab, 14 ref.

Descriptors: \*Snow, \*Mechanical properties, \*Strength, \*Measurement, Methodology, Construction materials, Strength of materials, Equipment, Instrumentation, Loads(Forces), Deformation, Stress, Density, Construction, Cold regions, Cold weather construction, Foundations, Roads, Runways, Rheology, Natural snow, Processed snow.

A review of snow strength characteristic tests was presented. Recommendations for using the most convenient methods and instruments in the field were given on the basis of a comparative analysis. The author has developed a classification of methods based on the "desirability of use" of a particular testing method. (See also W79-03596)(Sims-ISWS) W79-03627

#### FIELD ANALYSES OF PHYSIOMECHANICAL PROPERTIES OF ICE COVER.

For primary bibliographic entry see Field 2C. W79-03631

### 8I. Fisheries Engineering

#### BIOLOGICAL PROBLEMS WITH THE USE OF SEA WATER FOR COOLING.

Central Electric Generating Board, Fawley (England). Fawley Power Station.

For primary bibliographic entry see Field 5C. W79-03543

#### APPARATUS AND METHOD FOR SAMPLING WATER FOR FISH LARVAE AND OTHER TROPHIC LEVELS.

Lawler, Matusky and Skelly Engineers, Tappan, NY. (Assignee)

For primary bibliographic entry see Field 7B. W79-03781

### 9. MANPOWER, GRANTS AND FACILITIES

#### 9A. Education (Extramural)

#### RESEARCH ON MINNESOTA WATER PROBLEMS.

Minnesota Univ., St. Paul. Water Resources Research Center.

Available from the National Technical Information Service, Springfield, VA. 22161 as PB-290 585, Price codes: A03 in paper copy, A01 in microfiche. Public Report Series No. 3, 32p, June 1977. OWRT-A-999-MINN(46), 14-34-0001-7050.

Descriptors: \*Minnesota, \*Research, Education, \*Water Resources Act, \*Water Resource Institute.

This publication describes the Water Resources Act of 1964 and the origin of the University of Minnesota Water Resources Research Center, and reviews the Center's program. Results and conclusions of a number of research projects undertaken through the Center's program are reviewed. (Waelti-Minn) W79-03674

### 10. SCIENTIFIC AND TECHNICAL INFORMATION

#### 10C. Secondary Publication And Distribution

#### CLIMATE, CLIMATIC CHANGE, AND WATER SUPPLY.

National Research Council, Washington, DC.

For primary bibliographic entry see Field 2B. W79-03527

#### CHEMICAL ADDITIVES FOR IMPROVEMENT OF OIL SPILL CONTROL.

Rensselaer Polytechnic Inst., Troy, NY.

For primary bibliographic entry see Field 5G. W79-03575

#### AMMONIA AND NITRITE TOXICITY TO FISHES.

For primary bibliographic entry see Field 5C. W79-03932

#### INORGANIC SPECIES IN WATER: ECOLOGICAL SIGNIFICANCE AND ANALYTICAL NEEDS, A LITERATURE REVIEW.

Environmental Research Lab., Athens, GA.

For primary bibliographic entry see Field 5C. W79-03992

### 10E. Translations

#### HANDBOOK FOR HYDROGEOLOGISTS, VOLUME I, (SPRAVOCHNOE RUKOVODSTVO GIDROGEOLOGA).

For primary bibliographic entry see Field 4B. W79-03798

### 10F. Preparation Of Reviews

#### MICROBIOLOGY-WATERBORNE OUTBREAKS, (LITERATURE REVIEW).

National Environmental Research Center, Cincinnati, OH.

For primary bibliographic entry see Field 5C. W79-03773

#### EXECUTIVE SUMMARY OF DESALTING PLANS AND PROGRESS, AN EVALUATION OF THE STATE-OF-THE-ART AND FUTURE RESEARCH AND DEVELOPMENT REQUIREMENTS.

Fluor Engineers and Constructors, Inc., Irvine, CA.

For primary bibliographic entry see Field 3A. W79-03775

#### DESALTING PLANS AND PROGRESS, AN EVALUATION OF THE STATE-OF-THE-ART AND FUTURE RESEARCH AND DEVELOPMENT REQUIREMENTS,

Fluor Engineers and Constructors, Inc., Irvine, CA.

For primary bibliographic entry see Field 3A. W79-03776

#### SOURCE ASSESSMENT: OPEN MINING OF COAL, STATE OF THE ART,

Monsanto Research Corp., Dayton, OH.

For primary bibliographic entry see Field 5G. W79-03969

#### STATE-OF-THE-ART REPORT: PESTICIDE DISPOSAL RESEARCH,

Midwest Research Inst., Kansas City, MO.

For primary bibliographic entry see Field 5E. W79-03986

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W79-03841	5G	W79-03924	5C				
W79-03842	5C	W79-03925	5C				
W79-03843	5C	W79-03926	5A				
W79-03844	5A	W79-03927	5A				
W79-03845	5A	W79-03928	5A				
W79-03846	5A	W79-03929	5G				
W79-03847	5A	W79-03930	5C				
W79-03848	5A	W79-03931	5A				
W79-03849	5A	W79-03932	5C				
W79-03850	5A	W79-03933	5G				
W79-03851	5A	W79-03934	5C				
W79-03852	5A	W79-03935	5A				
W79-03853	5C	W79-03936	5C				
W79-03854	5C	W79-03937	5C				
W79-03855	5C	W79-03938	5B				
W79-03856	5C	W79-03939	5A				
W79-03857	5A	W79-03940	5A				
W79-03858	5C	W79-03941	5G				
W79-03859	5C	W79-03942	3F				
W79-03860	5C	W79-03943	5G				
W79-03861	5C	W79-03944	5G				
W79-03862	5C	W79-03945	2K				
W79-03863	5A	W79-03946	3F				
W79-03864	5C	W79-03947	3F				
W79-03865	5C	W79-03948	5G				
W79-03866	5C	W79-03949	3F				
W79-03867	5C	W79-03950	5G				
W79-03868	5C	W79-03951	5G				
W79-03869	5C	W79-03952	3F				
W79-03870	5C	W79-03953	3F				
W79-03871	5C	W79-03954	5G				
W79-03872	5A	W79-03955	5B				
W79-03873	5C	W79-03956	5G				
W79-03874	5C	W79-03957	5G				
W79-03875	5A	W79-03958	5G				
W79-03876	5A	W79-03959	5G				
W79-03877	5C	W79-03960	2D				
W79-03878	5A	W79-03961	2G				
W79-03879	5C	W79-03962	2G				
W79-03880	5A	W79-03963	2L				
W79-03881	5A	W79-03964	5B				
W79-03882	5A	W79-03965	2J				
W79-03883	5A	W79-03966	3E				
W79-03884	5C	W79-03967	5A				
W79-03885	5C	W79-03968	5G				
W79-03886	5D	W79-03969	5G				
W79-03887	5A	W79-03970	5B				
W79-03888	5C	W79-03971	6G				
W79-03889	5A	W79-03972	5B				
W79-03890	5C	W79-03973	5G				
W79-03891	5C	W79-03974	5C				
W79-03892	5C	W79-03975	5C				
W79-03893	5C	W79-03976	5C				
W79-03894	5C	W79-03977	5A				
W79-03895	5A	W79-03978	5A				
W79-03896	5C	W79-03979	5A				
W79-03897	5C	W79-03980	5A				
W79-03898	2H	W79-03981	5A				
W79-03899	5C	W79-03982	5A				
W79-03900	5C	W79-03983	5B				
W79-03901	5C	W79-03984	5B				
W79-03902	5C	W79-03985	5G				
W79-03903	5C	W79-03986	5E				
W79-03904	5C	W79-03987	5A				
W79-03905	5C	W79-03988	5B				
W79-03906	5C	W79-03989	5C				
W79-03907	5G	W79-03990	5C				
W79-03908	5G	W79-03991	5C				
W79-03909	5A	W79-03992	5C				
W79-03910	5A	W79-03993	5C				
W79-03911	5A	W79-03994	5D				
W79-03912	5C	W79-03995	5A				
W79-03913	5A	W79-03996	5A				
W79-03914	5C	W79-03997	5C				
W79-03915	5G	W79-03998	5B				

## SOURCE

A. CE

60

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B.

## ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTAL
<b>A. CENTERS OF COMPETENCE</b>		
Colorado State University, Irrigation Return Flow Quality	W79-03514, 03516 03521, 03530 03540, 03546 03552--03553 03595, 03653 03678, 03702 03705, 03828 03941--03959	33
Cornell University, Policy Models for Water Resources Systems	W79-03518--03520 03522--03529 03531--03539 03541--03542	22
DOE Oak Ridge National Laboratory, Nuclear Radiation and Safety	W79-03543--03545 03547--03551 03554--03557 03559--03561 03563--03567	20
Franklin Institute (FIRL), Municipal and Industrial Wastewater Treatment Technology	W79-03696, 03773	2
Illinois State Water Survey, Hydrology	W79-03596--03633 03798--03827 03898 03960--03962	72
University of Wisconsin, Eutrophication	W79-03507--03513 03515, 03757 03841--03894 03989--03993	68
<b>B. STATE WATER RESOURCES RESEARCH INSTITUTES</b>		
	W79-03590--03591 03593 03663--03677 03679--03685 03689, 03691 03695 03762--03764 03767--03772 03774, 03777	39

**ABSTRACT SOURCES**

<b>SOURCE</b>	<b>ACCESSION NUMBER</b>	<b>TOTAL</b>
C. OTHER		
Environmental Information Services, Inc. (Effects of Pollutants on Aquatic Life)	W79-03501--03506 03634--03652 03654--03659 03730, 03738 03895--03897 03899--03940 03994--04000	85
Information Planning Associates, Inc.	W79-03568--03583 03585--03588 03692--03694 03966--03988	46
National Oceanic and Atmospheric Administration	W79-03963--03965	3
Ocean Engineering Information Service (Patents)	W79-03778--03797	20
Ocean Engineering Information Service (Outer Continental Shelf)	W79-03829--03840	12
Office of Water Research and Technology	W79-03594 03660--03662 03686--03688 03765--03766 03775--03776	11
U. S. Geological Survey	W79-03558, 03562 03584, 03589 03592, 03690	6
University of Massachusetts (Wetlands)	W79-03697--03701 03703--03704 03706--03729 03731--03737 03739--03756 03758--03761	60

TOTAL

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